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February 12, 2000

OFFICE OF ENVIRONMENTAL  
QUALITY CONTROL

Ms. Genevieve Salmonson  
Office of Environmental Control  
235 South Beretania Street, Suite 702  
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Subject: Finding of No Significant Impact (FONSI) for the Smithsonian Astrophysical  
Observatory Base Facility, TMK: (3) 2-4-01 portion of 7, Hilo, Hawaii

The University of Hawaii at Hilo, Vice Chancellor of Administrative Affairs has reviewed the comments received during the 30-day public comment period which began on January 8, 2001. The agency has determined that this project will not have significant environmental effects and has issued a FONSI. Please publish this notice in the February 23, 2001 OEQC *Environmental Notice*.

We have enclosed a completed OEQC Publication Form and four copies of the final EA. Please call Lo-Li Chih at (808) 974-7595 if you have any questions.

Sincerely,

John Whittaker  
Vice Chancellor  
Administrative Affairs

Enclosures

*Administrative Affairs*

200 W. KAWILI STREET  
HILO, HAWAII 96720-4091  
PHONE: (808) 974-7750  
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FINAL ENVIRONMENTAL ASSESSMENT for the

Smithsonian Astrophysical Observatory SMA Hilo Base Facility

Prepared for:  
Smithsonian Astrophysical Observatory  
60 Garden Street  
Cambridge, Massachusetts 02138

Prepared by:



February 2001

FINAL ENVIRONMENTAL ASSESSMENT for the

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## Smithsonian Astrophysical Observatory SMA Hilo Base Facility

Prepared for:  
Smithsonian Astrophysical Observatory  
60 Garden Street  
Cambridge, Massachusetts 02138

Prepared by:



February 2001

SMITHSONIAN ASTROPHYSICAL OBSERVATORY SMA HILO BASE FACILITY  
FINAL ENVIRONMENTAL ASSESSMENT

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## 1.0 INTRODUCTION

The Smithsonian Institution is proposing to construct its astronomy base facility in the University of Hawai'i at Hilo's "University Park" to support the Submillimeter Array (SMA) Science Group's antennas project on the summit of Mauna Kea. The SMA Science Group is a collaborative project of the Smithsonian Astrophysical Observatory (SAO), the Harvard-Smithsonian Center for Astrophysics (CfA), and the Institute of Astronomy and Astrophysics of the Academia Sinica of Taiwan.

### 1.1 PROJECT SUMMARY

Project Title: Smithsonian Astrophysical Observatory SMA Hilo Base Facility

Applicant: Smithsonian Astrophysical Observatory  
60 Garden Street  
Cambridge, MA 02138

Contact: James M. Moran, Ph.D. Phone: (617) 495-7477

Location: University Park, University of Hawai'i at Hilo, Hilo, Hawai'i  
TMK: 2-4-01: portion of 7

Property Owner: Held in trust by the State of Hawai'i, the entire parcel, which is ceded land, is leased by the University of Hawai'i at Hilo

Existing Uses: Vacant

Proposed Action: Construction of an Astronomy Base Facility at University Park, Hilo, Hawai'i

Project Area: Approximately 2.5 Acres

State Land Use: Urban District

Special Management Area: The subject property is not in the Special Management Area.

County Zoning: RS-10

Action Requested: Compliance with Chapter 343, *Hawai'i Revised Statutes*



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Accepting Authority: University of Hawai'i at Hilo, Vice Chancellor of Administrative Affairs

Determination: Finding of No Significant Impact (FONSI)

## **1.2 ENVIRONMENTAL COMPLIANCE**

This environmental assessment is prepared in compliance of State of Hawai'i, Chapter 343, *Hawai'i Revised Statutes* for the use of state lands in accordance with Hawai'i Administrative rules, Title 11, Department of Health, Chapter 200.

## **1.3 LOCATION**

The proposed area is located in Waiakea, District of South Hilo, Hawai'i (Figure 1), Tax Map Key: (3) 2-4-01: portion of 7 (Figure 2). It consists of an approximately 2.5 acre portion of a 202.736 acre parcel used by the University of Hawai'i at Hilo (Figure 3).

## **1.4 LAND OWNERSHIP**

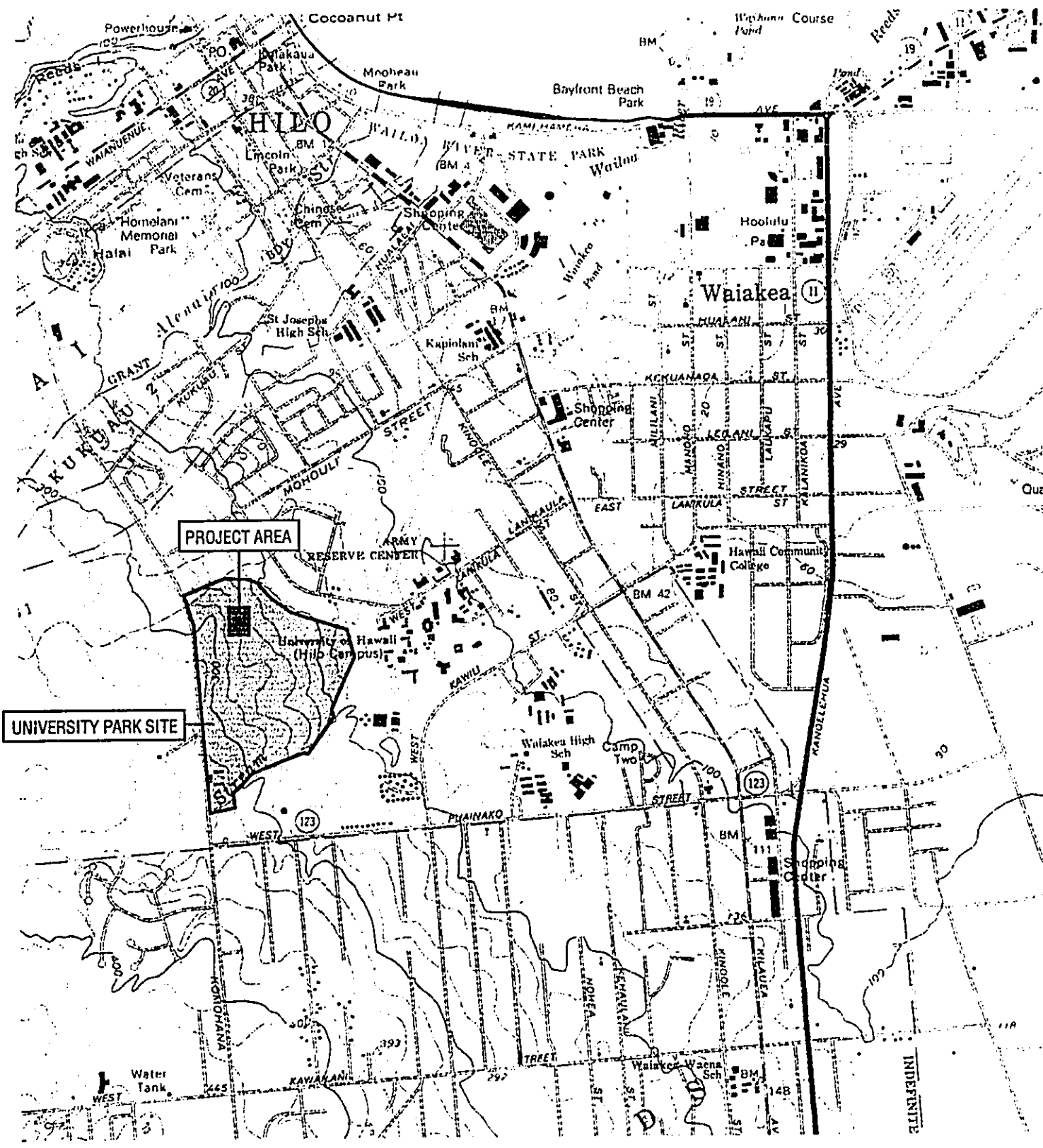
University Park, in which the proposed Smithsonian Institution project will be located, is held in trust by the State of Hawai'i. The entire University Park area is on ceded land and is leased and used by the University of Hawai'i at Hilo.



## **1.5 BACKGROUND**

The Smithsonian Institution is proposing to construct an astronomy base facility in Hilo Hawai'i at the University of Hawai'i at Hilo's "University Park" (Figure 3) to support the Submillimeter Array (SMA) Science Group's (a collaborative project of the Smithsonian Astrophysical Observatory (SAO), the Harvard-Smithsonian Center for Astrophysics (CfA), and the Institute of Astronomy and Astrophysics of the Academia Sinica of Taiwan) antennas project on the summit of Mauna Kea.

In September 1997, a Final Environmental Impact Statement (prepared pursuant to Chapter 343, Hawai'i Revised Statutes) was filed for the University of Hawai'i at Hilo (UH Hilo) (*Final Environmental Impact Statement for the University of Hawai'i at Hilo University Park, Hilo, Hawai'i, TMK: 2-4-01:7, 12, 19, 41 and 2-4-03: 26, September 1997*). The proposed action for the 1997 Final EIS involved the development of the University Park in Hilo, Hawai'i.

The University Park is a 116-acre expansion of UH Hilo and was proposed to include a research and technology park, academic facilities, recreational facilities and student housing. The proposed Smithsonian Institution project is located within the area proposed



- LEGEND**
-  Project Area
  -  University Park Site

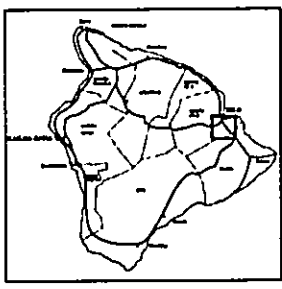
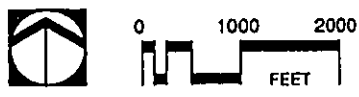
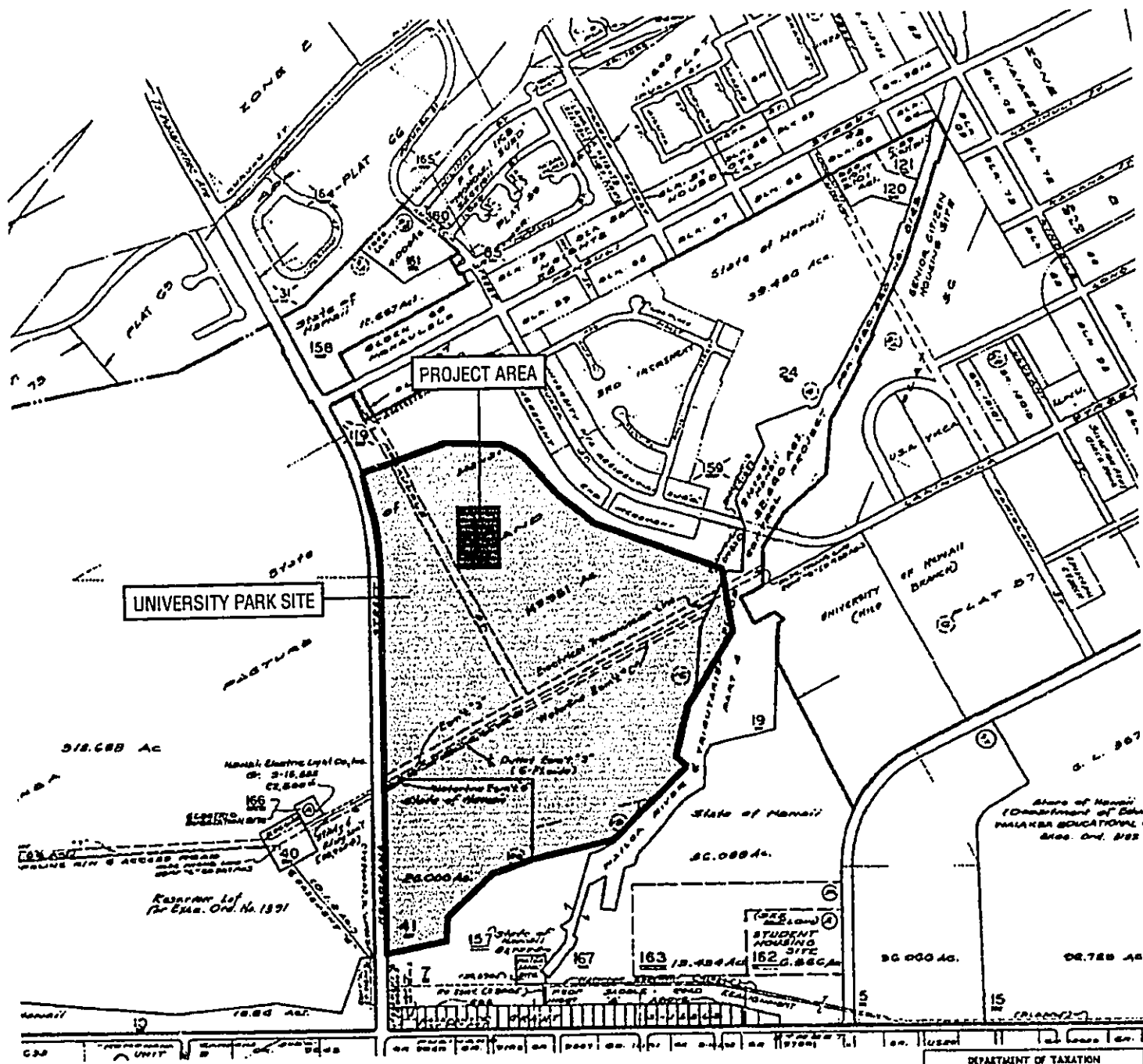


FIGURE I  
Regional Location Map  
**SI/SMA Hilo Base Facility**

Source: USGS Topographical Map





UNIVERSITY PARK SITE

PROJECT AREA

DEPARTMENT OF TAXATION		
TAXATION MAPS BUREAU		
STATE OF HAWAII		
TAX MAP		
THIRD	TAXATION DIVISION	
ZONE	SEC	PLAT
2	4	01

**LEGEND**

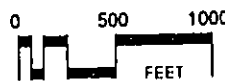
-  Project Area
-  University Park Site

Source: Tax Map Key

FIGURE 2

Tax Map Key

# SI/SMA Hilo Base Facility



December 2000



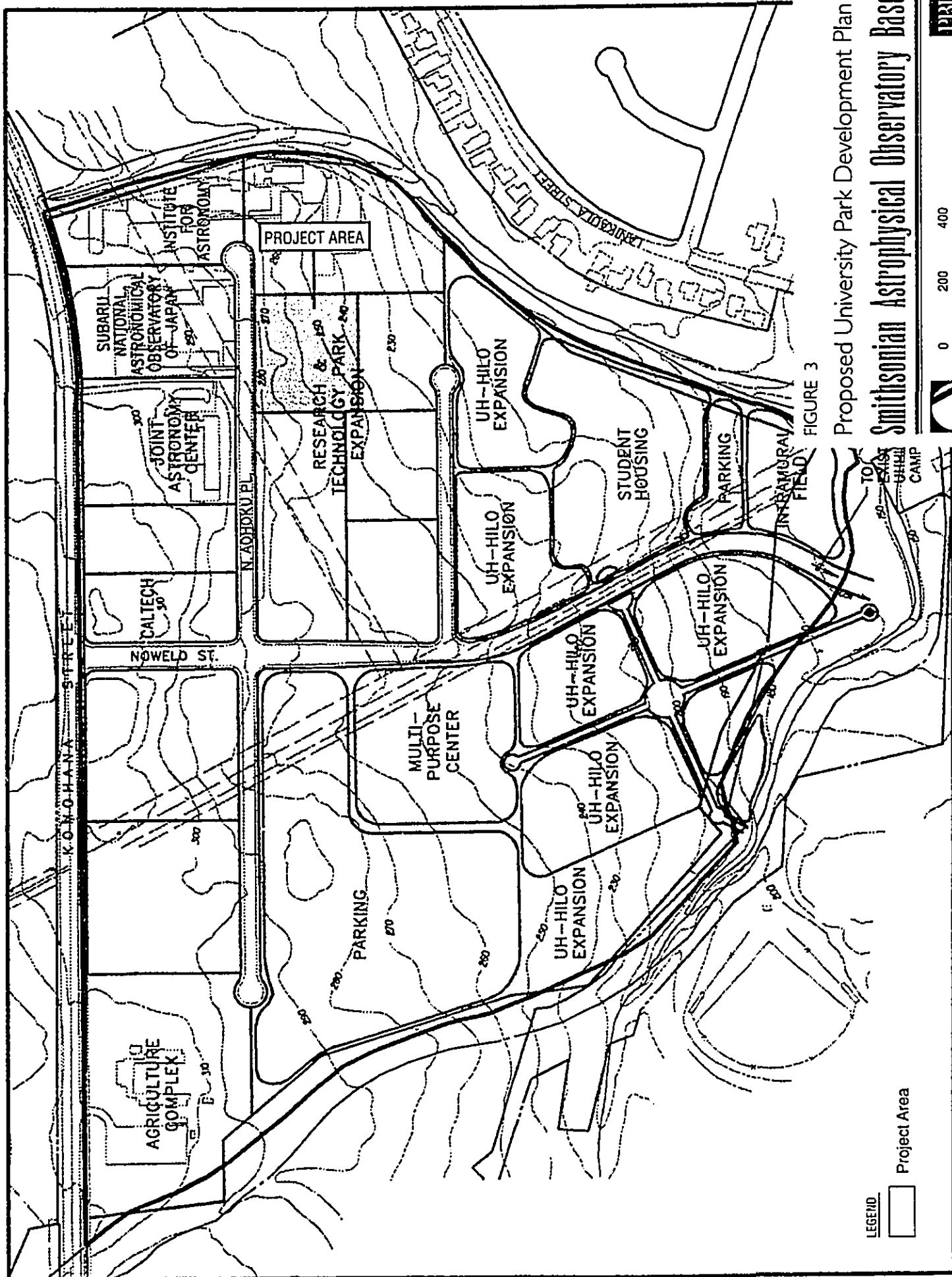
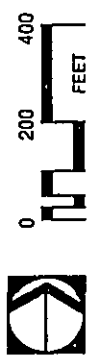


FIGURE 3

Proposed University Park Development Plan  
 Smithsonian Astrophysical Observatory Base

LEGEND  
 [ ] Project Area



October 2000

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for "Research & Technology Park Expansion" (as shown on Figure 3). The impacts of a research and technology facility such as the proposed Smithsonian Institution project were addressed and reviewed by numerous Federal, State and County agencies during the preparation of the 1997 Final EIS.

Additionally, in April 1997, a Final Environmental Assessment (prepared pursuant to both Chapter 343, HRS and Title 40, Code of Federal Regulations, Chapter V, Parts 1500 to 1508) was prepared for a similar facility, Hilo Base Facility of the Gemini North 8-Meter Telescope, which is located across the street from the proposed Smithsonian Institution astronomy base facility within the University Park (*Final Environmental Assessment for the Proposed Hilo Base Facility of the Gemini North 8-Meter Telescope by Association of Universities for Research in Astronomy (AURA)*, April 1997).

A draft of the Environmental Assessment for the proposed Hilo Base Facility of the Gemini North 8-Meter Telescope was submitted to the State of Hawai'i Office of Environmental Quality Control (OEQC) for publication in its March 8, 1997 issue of its bulletin notifying the public of its availability for public comment. Copies of the Environmental Assessment were also mailed to a number of federal, state and county agencies identified by OEQC. During the comment period, only one comment was received (from the Office of Hawaiian Affairs). This comment related to a clarification of the ownership of the property.

## **1.6 IDENTIFICATION OF THE APPLICANT**

The applicant is the Smithsonian Astrophysical Observatory.

## **1.7 IDENTIFICATION OF APPROVING AGENCY**

The approving agency is the University of Hawai'i at Hilo, Vice Chancellor of Administrative Affairs.

## **1.8 IDENTIFICATION OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS**

### **1.8.1 Parties consulted during the preparation of the Draft EIS for the University of Hawai'i at Hilo University Park**

During the preparation of the 1997 Draft and Final EIS, a number of agencies, organizations and individuals were sent copies of the environmental assessment ("EIS Preparation Notice"), and of the Draft EIS. Fifty (50) copies of the EIS Preparation Notice were mailed to agencies, organizations and other interested parties. A complete listing of these consulted parties follows.

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Federal Government

Department of Agriculture, Natural Resources Conservation Service  
Department of the Army, Corps of Engineers  
Department of Commerce, National Marine Fisheries Service  
Department of the Interior:  
    Fish and Wildlife Service  
    Geological Survey  
    National Park Service  
Department of Transportation, Federal Aviation Administration

State Government

State Senator, District 1  
State Representative, District 1  
Department of Accounting and General Services, Division of Public Works  
Department of Agriculture  
Department of Business Economic Development and Tourism:  
    Energy Resources and Technology Division  
    Land Use Commission  
    Office of Planning  
Department of Defense  
Department of Education  
Department of Hawaiian Home Lands, Hawaiian Homes Commission  
Department of Health, Environmental Planning Office  
Department of Land and Natural Resources:  
    Historic Preservation Division  
    Land Division  
Department of Transportation  
Office of Environmental Quality Control  
Office of Hawaiian Affairs  
University of Hawai'i:  
    Environmental Center  
    Water Resources Research Center

County Government

Council Member, District 1  
Fire Department  
Department of Parks and Recreation  
Planning Department  
Police Department

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Department of Public Works  
Department of Research and Development  
Department of Water Supply

Other Interested Parties

American Lung Association  
GTE Hawaiian Telephone Company  
Hawai'i Electric Light Company, Inc.  
Nelson Ho

**1.8.2 Parties consulted during preparation of the Final EIS for the University of Hawai'i at  
Hilo University Park**

Seventy (70) copies of the Draft EIS were mailed to agencies, organizations and other interested parties. A complete list of these consulted parties follows.

Federal Government

Department of Agriculture, Natural Resources Conservation Service  
Department of the Army:  
    U.S. Army Engineer District, Honolulu  
    Directorate of Facilities Engineer  
Department of the Navy, Naval Base Pearl Harbor  
Department of the Interior:  
    Fish and Wildlife Service  
    Geological Survey  
Department of Transportation, 14th Coast Guard District  
Environmental Protection Agency, Region IX

State Government

State Senator, District 1  
State Representative, District 1  
Department of Accounting and General Services, Division of Public Works  
Department of Agriculture  
Department of Business Economic Development and Tourism:  
    Energy Resources and Technology Division  
    Land Use Commission  
    Office of Planning  
Department of Defense  
Department of Education

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Department of Health, Environmental Planning Office  
Department of Land and Natural Resources:  
    Historic Preservation Division  
    Land Division  
Department of Transportation  
Housing Finance and Development Corporation  
Office of Environmental Quality Control  
Office of Hawaiian Affairs  
University of Hawai'i:  
    Environmental Center  
    Water Resources Research Center

County Government

Council Member, District 1  
Fire Department  
Department of Parks and Recreation  
Planning Department  
Police Department  
Department of Public Works  
Department of Research and Development  
Department of Water Supply

Other Interested Parties

American Lung Association  
Hawai'i Electric Light Company, Inc.  
Honolulu Star Bulletin  
Honolulu Advertiser  
Sun Press  
Hawai'i Tribune Herald  
West Hawai'i Today  
Sidney Fuke & Associates



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## 2.0 PROJECT DESCRIPTION

### 2.1 PROPERTY DESCRIPTION AND BACKGROUND INFORMATION

The proposed project is located in the city of Hilo on the island of Hawai'i (TMK: 2-4-01: 7 and 41) (Figures 1, 2, & 3). Hilo is located on the eastern coast of the island, serves as the center for the County of Hawai'i and State of Hawai'i government agencies, and is the most populous city on the island, with a population of about 46,000.

The University of Hawai'i at Hilo (UH Hilo) is one of the ten campuses that comprise the University of Hawai'i system. The campus was established in 1970 and is a comprehensive undergraduate institution that offers certificates in various vocational fields and baccalaureate degrees. The existing campus is located approximately two miles southwest of Hilo airport and occupies about 117 acres. The campus is bound by Lanikaula, Kapi'olani, Kāwili and Puainako Streets, and the Wailoa Flood Control Channel along Waiakea Stream.

The island of Hawai'i possesses natural advantages for scientific research, especially in astronomy and geophysics. One of the best sites in the world for astronomical observation is the summit of Mauna Kea, which rises nearly 14,000 feet above sea level. Various universities, institutions, and countries operate telescopes from the observatories situated at the summit. The Hawaiian Volcano Observatory near Kilauea Crater is another prominent research center. Climatological research is conducted at the University of Hawai'i's laboratory on the slopes of Mauna Loa.

#### 2.1.1 Surrounding Land Uses

The site is located within University Park. University Park encompasses an approximate area of 116 acres located west of the existing UH Hilo campus. The site is bound by a localized drainage ditch and the University Heights subdivision to the north, Komohana Street to the west and the Wailoa Flood Control Project (Nalakea Stream) to the east. Two utility easements bisect the site in a northeast to southwest direction.

Two existing roads traverse the University Park. Nowelo Street (aligned in an east-west direction), provides the main entry to the University Park site from Komohana Street. Nowelo Street extends approximately 1,150 feet east into the site from the intersection with Komohana Street. North Aohoku Place runs parallel to Komohana Street, extending north about 1,250 feet from its intersection with Nowelo Street to a cul-de-sac. Both roads feature asphalt concrete pavements and concrete curbs and gutters. The proposed project is located north of Nowelo Street and would be accessed by North Aohoku Place.

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Current tenants within the University Park include the Joint Astronomy Center, the CALTECH Submillimeter Observatory, the Subaru National Astronomical Observatory of Japan, the Gemini North 8-Meter Telescope, and the Institute for Astronomy.

## **2.2 PROJECT DEVELOPMENT GOALS AND OBJECTIVES**

The proposed astronomy base facility is intended to support the Submillimeter Array, now under construction near the summit of Mauna Kea. The Submillimeter Array is a collaborative project of the Smithsonian Astrophysical Observatory (SAO), part of the Harvard-Smithsonian Center for Astrophysics (CfA), and the Institute of Astronomy and Astrophysics of the Academia Sinica of Taiwan. The Submillimeter Array is an exploratory instrument for high resolution observations at submillimeter wavelengths, between the millimeter band where several interferometers are now operating and the far-infrared regime accessible only from airplane or space. The Submillimeter Array will initially consist of eight six-meter antennas sited on Mauna Kea at an elevation of 4,050 meters (13,287 feet above mean sea level).

An imaging array at submillimeter wavelengths has applications in many areas of astrophysics. In general, the Submillimeter Array will be most sensitive to emission from material at temperatures of a few tens of thousands degrees whose spectra peak in the submillimeter. Diagnostic probes at these wavelengths include thermal continuum emission, rotational lines of light molecules, and atomic fine structure lines. These emissions often arise in compact regions, for example in the immediate vicinity of young stars or evolved stars in the Galaxy, in protoplanetary disks, in active regions of distant galaxies, and Solar System bodies, all places where arcsecond (or better) resolution will be especially valuable.

## **2.3 DESCRIPTION OF PROJECT AND SITE**

The proposed action involves the construction of an astronomy base facility on an approximately 2.5 acre site within a master planned research and technology park of the University of Hawai'i at Hilo. The building will be approximately 35 feet high, will provide approximately 18,170 square feet of floor area and will have approximately 46 parking stalls. The building will be of composite construction with a steel roof. The architectural character of the building (design, roof shape, colors) will be compatible with the predominant architectural design of the rest of the University of Hawai'i at Hilo. The building and parking lot will be landscaped with plants suited to the climate of the area. The building, parking lot, and the rest of the site will be designed to be fully accessible according to the guidelines provided by the Americans with Disability Act.

The building will serve as SAO's headquarters for base support and research personnel of the observatory. Construction would be completed over two phases. The structure will

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include research and clerical support offices and conference, library, and laboratory areas. The basic building elevations will be about 35 feet. The maximum height within the single-family residential zone is 35 feet, thus making this height consistent with this zoning.

Setback from North Aohoku Place will be in excess of 42 feet. Setback from Komohana Street will also be in excess of 400 feet. It should be noted that there is a 50-foot wide undisturbed natural landscape buffer and a row of buildings between Komohana Street and the subject site.

Also proposed is the provision of forty-six (46) paved parking stalls on the site. The minimum parking requirement for the 18,170 square foot building according to the County Zoning Code is 45.42 (1 stall for every 400 square feet of gross building area).

Landscaping will be added around the building and the site. When appropriate, indigenous plants will be used.

Construction of the first phase is expected to begin within the third quarter of 2001. The first phase is anticipated to be completed within a year of that period. The second phase would be constructed and completed over the next five (5) years. The construction cost of phase I is estimated at \$3.5 million in 2000 dollars.

An estimated thirty-five to forty personnel are expected to be employed to provide clerical staff and technical support work for the observatory located at the summit. The majority of the base facility employees are expected to work Monday through Friday, generally between the hours of 7:00 AM to 5:00 PM. There may be a continued presence of staff 24-hours a day, with a reduced number of staff working during the night in support of observation activities on Mauna Kea.

## **2.4 SUSTAINABLE BUILDING DESIGN**

The Office of Environmental Quality Control has issued "Guidelines for Sustainable Building Design In Hawai'i: A planner's checklist" (OEQC May 1999) and has requested that consideration be made in applying sustainable building techniques to projects. The OEQC Guidelines state that "(a) sustainable building is built to minimize energy use, expense, waste and impact on the environment. It seeks to improve the region's sustainability by meeting the needs of Hawai'i's residents and visitors today without compromising the needs of future generations."

An evaluation of the plans for the Smithsonian Astrophysical Observatory SMA Hilo Base Facility indicates that the building will apply many of the techniques described in the Guidelines to: 1) use less energy for operation and maintenance, 2) preserve and conserve water and other natural resources, 3) minimize health risks to those who

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construct, maintain and occupy the building, 4) minimize construction waste, 5) recycle and reuse generated constructed wastes, 6) provide the highest quality product practical at competitive (affordable) costs. Some of the measures the project will implement include:

- Siting building(s) to take advantage of natural features and maximize their beneficial effect..
- Minimize the disruption of site drainage pattern.
- Incorporate daylighting controls and/or motion activated light controls in low or intermittent use areas.
- Exceed the State of Hawaii Model Energy Code requirements.
- Use renewable energy. Use solar water heaters and consider the use of photovoltaics and Building Integrated Photovoltaics.
- Use durable products, preferably locally produced.
- Use separate HVAC systems to serve areas that operate on widely differing schedules and/or design conditions.
- Install water conserving, low flow fixtures as required by the Uniform Plumbing Code.

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### 3.0 LAND USE CONFORMANCE

Relevant State of Hawai'i and county of Hawai'i land use plans, policies, and ordinances are described below.

#### 3.1 STATE OF HAWAI'I

##### 3.1.1 State Land Use District

The State Land Use Law (Chapter 205, Hawai'i Revised Statutes) establishes the framework of land use management in Hawai'i. All lands in the state are classified into one of the following four land use districts: Urban, Rural, Agricultural, or Conservation.

The project site is located on land classified as Urban (U). The Urban classification generally includes land characterized by a city-like concentration of people, structures and services, including vacant areas for future development. The counties primarily have jurisdiction over urban lands through their land use ordinances and regulations. The proposed facility is thus consistent with existing State Urban designation.

##### 3.1.2 Hawai'i State Plan

The Hawai'i State Plan (Chapter 226, HRS) establishes a system for the planning, coordination, and integration of major state and county activities. Part I of the Plan lists the State's long-range goals, objectives, policies and priorities. Part II establishes a statewide planning system to coordinate and implement the plan. Part III establishes priority guidelines to address areas of statewide concern. Applicable sections are discussed below.

Section 226-10 Objective and policies for the economy—potential growth activities.

- (a) *Planning for the State's economy with regard to potential growth activities shall be directed towards achievement of the objective of development and expansion of potential growth activities that serve to increase and diversify Hawai'i's economic base.*
- (8) *Develop, promote and support research and educational training programs that will enhance Hawai'i's ability to attract and develop economic activities of benefit to Hawai'i.*

Discussion: The proposed project represents implementation of the master planned UH Hilo University Park, promoting research and educational opportunities and allowing for growth in enrollment.

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Section 226-21 Objective and policies for socio-cultural advancement--education

- (a) *Planning for the State's socio-cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspiration.*
- (b) *To achieve the educational objective, it shall be the policy of the State to:*
- (2) Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.*
  - (5) Provide higher educational opportunities that enable Hawai'i's people to adapt to changing employment demands.*
  - (9) Support research programs and activities that enhance the education programs of the State.*

Discussion: The continuation of development of the University Park will expand the educational facilities of the UH Hilo campus, attracting increased enrollment and providing higher education opportunities.

Section 226-103 Economic priority guidelines.

- (a) *Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawai'i's people and achieve a stable and diversified economy:*
- (2) Encourage expansion of technological research to assist industry development and commercialization of technological advancements.*

Discussion: The proposed project is part of the master planned UH Hilo Research and Technology Park.

Section 226-107 Quality Education

*Priority guidelines to promote quality education:*

- (6) Pursue the establishment of Hawai'i's public and private universities and colleges as research and training centers of the Pacific.*

Discussion: The proposed project supports this objective by strengthening one of UH Hilo's major programs, astronomy.

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### 3.1.3 Hawai'i Coastal Zone Management Program

The objectives of the Coastal Zone Management (CZM) Program, (Section 205A-2, HRS), are to provide the public with recreational opportunities, protect historic and prehistoric resources, protect scenic and open space resources, protect coastal ecosystems, provide facilities for economic development, reduce hazards, and manage development.

A discussion of the CZM Program objectives applicable to the SAO Base Facility is presented below.

#### 1. RECREATIONAL RESOURCES

*Objective:*

*Provide coastal recreational opportunities accessible to the public.*

*Policies:*

- 1.b. Provide adequate, accessible and diverse recreational opportunities in the coastal zone management area by:*
- iii. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
- vi. Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*

Discussion: Inasmuch as the subject property is located well inland from the coastline, access to coastal resources will not be impacted by the proposed SAO Base Facility. In addition, the Applicant will institute Best Management Practices (BMPs) to ensure there be no impact to downstream areas from current conditions.

#### 2. HISTORIC RESOURCES

*Objective:*

*Protect, preserve, and where desirable, restore those natural and man made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*

*Policies:*

- 2.a. Identify and analyze significant archaeological resources;*
- 2.b. Maximize information retention through preservation of remains and artifacts or salvage operations; and*

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- 2.c. *Support state goals for protection, restoration, interpretation and display of historic resources.*

Discussion: Archaeological surveys of the University Park site were conducted in 1992 and 1993. There were no archaeological sites discovered on the SAO Base Facility site during these surveys. However, should any archaeologically significant artifacts, bones, or other indicators of previous on-site activity be uncovered during the construction phases of development, their treatment will be conducted in strict compliance with the requirements of the Department of Land and Natural Resources, State Historic Preservation Division.

3. *SCENIC AND OPEN SPACE RESOURCES*

*Objective:*

*Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.*

*Policies:*

- 3.a. *Identify valued scenic resources in the coastal zone management area;*
- 3.b. *Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline.*
- 3.d. *Encourage those developments which are not coastal dependent to locate in inland areas.*

Discussion: Coastal scenic resources will not be significantly affected since all of the project area is located approximately 8,000 feet (or over a mile and a half) from the shoreline and outside of the Special Management Area. Applicable zoning regulations will restrict heights and density of development, which with landscaping will mitigate visual impacts. Generous provisions for open space and landscaping have also been provided by the SAO Base Facility. No significant natural landforms will be altered.

4. *COASTAL ECOSYSTEMS*

*Objective:*

*Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.*



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*Policies:*

- 4.a. *Improve the technical basis for natural resource management;*
- 4.b. *Preserve valuable coastal ecosystems of significant biological or economic importance.*
- 4.d. *Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards.*

Discussion: The SAO Base Facility property is not located on the shoreline. However, the development will incorporate measures necessary to mitigate any water quality impacts from surface run-off in accordance with applicable State Department of Health and County of Hawai'i regulations. Drainage improvements will be designed to control the quantity and quality of surface water to keep runoff to off-site areas at the same levels as current flows. This will mitigate potential impacts to coastal resources by improving water quality before runoff leaves the site and by restricting the quantity of runoff to current levels. Similarly, construction related impacts will be mitigated by the implementation of best management practices to control erosion.

5. ECONOMIC USES

*Objective:*

*Provide public or private facilities and improvements important to the State's economy in suitable locations.*

*Policies:*

- 5.a. *Concentrate coastal dependent development in appropriate areas;*
- 5.b. *Ensure that coastal dependent development such as harbors and ports, visitor industry facilities and energy generating facilities are located, designed and constructed to minimize adverse social, visual and environmental impacts in the coastal zone management area.*
- 5.c. *Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside presently designated areas when:*
  - ii. *Adverse environmental effects are minimized.*
  - iii. *The development is important to the State's economy.*

Discussion: SAO Base Facility will not include coastal dependent development. Consequently, all the land uses planned by the project are located well in-land from coastal areas and are appropriate uses of the property. Therefore, existing coastal areas

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will be unaffected by the project. Expanded employment opportunities will result from the future development of the SAO Base Facility, which will result in significant social benefits.

6. COASTAL HAZARDS

*Objective:*

*Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

*Policies:*

- 6.b Control development in areas subject to storm wave, tsunami, flood, erosion and subsidence.*
- 6.c. Ensure that developments comply with the requirements of the Federal Flood Insurance Program.*

Discussion: The established governmental agency and public review process, along with the various permits required for the proposed project, ensure that adequate governmental controls are being applied. The proposed SAO Base Facility will be designed and constructed in compliance with all applicable federal, state, and county environmental protection, design and building standards and regulations.

Any possible impact to near-shore ecosystems resulting from surface runoff will be mitigated by implementation of best management practices during the construction phases of development. Development of drainage systems will follow Hawai'i County design standards to ensure the safe conveyance and discharge of storm runoff.

In addition, none of the subject property is located within the County's Special Management Area. As such, all phases of development will comply with federal, state, and county requirements relating to natural hazards.

7. MANAGING DEVELOPMENT

*Objective:*

*Improve the development review process, communication and public participation in the management of coastal resources and hazards.*

*Policies:*

- 7.a. Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development.*

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- 7.b. *Facilitate timely processing of application for development permits and resolve overlapping or conflicting permit requirements.*
- 7.c. *Communicate the potential short- and long-term impacts of proposed significant coastal developments early in their life-cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.*

Discussion: The applications for required land use entitlements will be reviewed by both County and State land use planning agencies. Further, the University of Hawai'i at Hilo met with appropriate County agency personnel as well as individuals and community groups to communicate the proposed plan for University Park and to solicit comments for incorporation into the planning process for the University of Hawai'i at Hilo Long Range Development Plan. As such, no coastal resources or hazards will be impacted by approval of the proposed project, and the community has been kept informed of the project's progress through the county planning and environmental review process. The proposed project site is not located within a Special Management Area and therefore, a Special Management Area Use Permit is not required.

**8. PUBLIC PARTICIPATION**

*Objective:*

*Stimulate public awareness, education, and participation in coastal management.*

*Policies:*

- 8.a. *Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;*
- 8.b. *Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal-related issues, developments, and government activities; and*
- 8.c. *Organize workshops, policy dialogues, and site-specific mediation to respond to coastal issues and conflicts.*

Discussion: As the project is located well inland from the ocean, the area is not located on a beach, nor will the proposed development impact coastal resources. Public participation in the planning of the project included the public review process for the 1997 Final Environmental Impact Statement for the University of Hawai'i at Hilo University Park.

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9. BEACH PROTECTION

*Objective:*

*Protect beaches for public use and recreation.*

*Policies:*

- 9.a. *Locate new structure inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;*
- 9.b. *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*
- 9.c. *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

Discussion: The project area is not located on a beach, nor will the proposed development impact coastal resources.

10. MARINE RESOURCES

*Objective:*

*Implement the State's ocean resources management plan.*

*Policies:*

- 10.a. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*
- 10.b. *Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*
- 10.c. *Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;*
- 10.d. *Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;*
- 10.e. *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and*
- 10.f. *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

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Discussion: The project area is not located on a beach, nor will the proposed development impact coastal or marine resources.

### **3.2 COUNTY OF HAWAII**

#### **3.2.1 General Plan**

The General Plan was originally adopted in 1971 and comprehensively revised in 1989 through county Ordinance 89-142. The General Plan states courses of action for each of the Island's districts. For South Hilo, the general course of action is encouragement of commercial endeavors. The Plan also encourages development of UH Hilo, but warns that development relies on State funds which will be subject to competition from other counties.

Several courses of action apply to the proposed project:

Economic Development. The General Plan directs the county to encourage the State to provide necessary funding for the development of the university complex, and to provide necessary support services and facilities to aid the development of these complexes.

Public Facilities. The General Plan directs the county to support the expansion of the university system, specifically as related to the campus master plan.

The proposed project implements the Long Range Development Plan for the University of Hawaii at Hilo.

#### **3.2.2 Special Management Area**

The project site is not in the Special Management Area (SMA).

#### **3.2.3 County Zoning**

According to the County of Hawaii Planning Department, the property is situated within the county's Single Family Residential (RS-10) zoned district and is designated University Use by the Hawaii County General Plan LUPAG map.

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**3.2.4 List of Permits**

During the implementation stages of the project, the applicant will be working with the State and County review agencies for examination and approval of project plans and specifications.

The following permits will be required as part of the project:

<u>Permit or Approval</u>	<u>Authority</u>
Grading/Building Permits	Department of Planning and Permitting
Drainage Permit	Department of Public Works
NPDES Permit	Department of Health

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#### 4.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT, POTENTIAL IMPACTS OF THE PROPOSED ACTION, AND MITIGATIVE MEASURES

The environment surrounding the proposed project includes the physical or natural environment and the human or social environment. This section describes the existing conditions, potential impacts to the environment, and proposed mitigative measures.

##### 4.1 PHYSICAL CHARACTERISTICS

###### 4.1.1 Climate

Hilo is located on the eastern (windward) side of the island and is usually subject to northeasterly (onshore) winds during the day. Wind speeds predominately range from 4 to 12 miles per hour, however, diurnal heating and cooling occasionally give rise to offshore (southwesterly) breezes at night.

Daytime temperatures range from the upper 70's to low 80's (degrees Fahrenheit). Temperatures at night range from the low 60's to the upper 70's.

Mean annual rainfall averages about 141 inches. Although the wet season usually occurs from October through April, rain falls approximately 280 days of the year.

###### *Potential Impacts and Mitigative Measures*

The proposed project is not expected to have a significant effect on climatic conditions and no mitigative measures are planned. Project landscaping may help to decrease any localized temperature increases resulting from the increase in paved areas.

###### 4.1.2 Topography

The elevation of the site ranges from approximately 280 to 240 feet above mean sea level (MSL). The topography of the site is sloping, with slope range of approximately 13 percent in an east to west direction. The historical use of the site has been associated with agricultural uses (sugar cane, pasture). The project site currently contains no permanent structures, however it is being used as a temporary construction staging area for the adjoining Institute for Astronomy building (which is nearly complete).

###### *Potential Impacts and Mitigative Measures*

The project will require vegetation removal, earthwork, and grading. All grading operations will be conducted in full compliance with dust, erosion control and other requirements of the County of Hawai'i. All construction activities will comply with the

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provisions of Chapter 11-60.1, Hawai'i Administrative Rules, on fugitive dust. A grading permit is required to modify the topography.

#### 4.1.3 Soils

Soil types within the subject parcel are identified in the U.S. Soil Conservation Service Soil Survey as Pāhoehoe lava flows (rLW); and Keaukaha Extremely Rocky Muck, 6 to 20 percent slopes (rKFD) (see Figure 4). Pāhoehoe lava flows dominate the western third of the site, fronting Komohana Street. This classification is characterized by a relatively smooth, billowy, glassy surface which has no soil covering and is typically bare of vegetation except for mosses and lichens.

Keaukaha Extremely Rocky Muck is rapidly permeable, dark brown muck underlain by pāhoehoe lava bedrock. The soil is strongly acid, with rock outcrops occupying about 25 percent of the area. Runoff is medium and erosion hazard is slight.

Soil types at the project site also includes Pana'ewa Very Rocky Silty Clay Loam (19 to 20 percent slopes) which is known to be unstable.

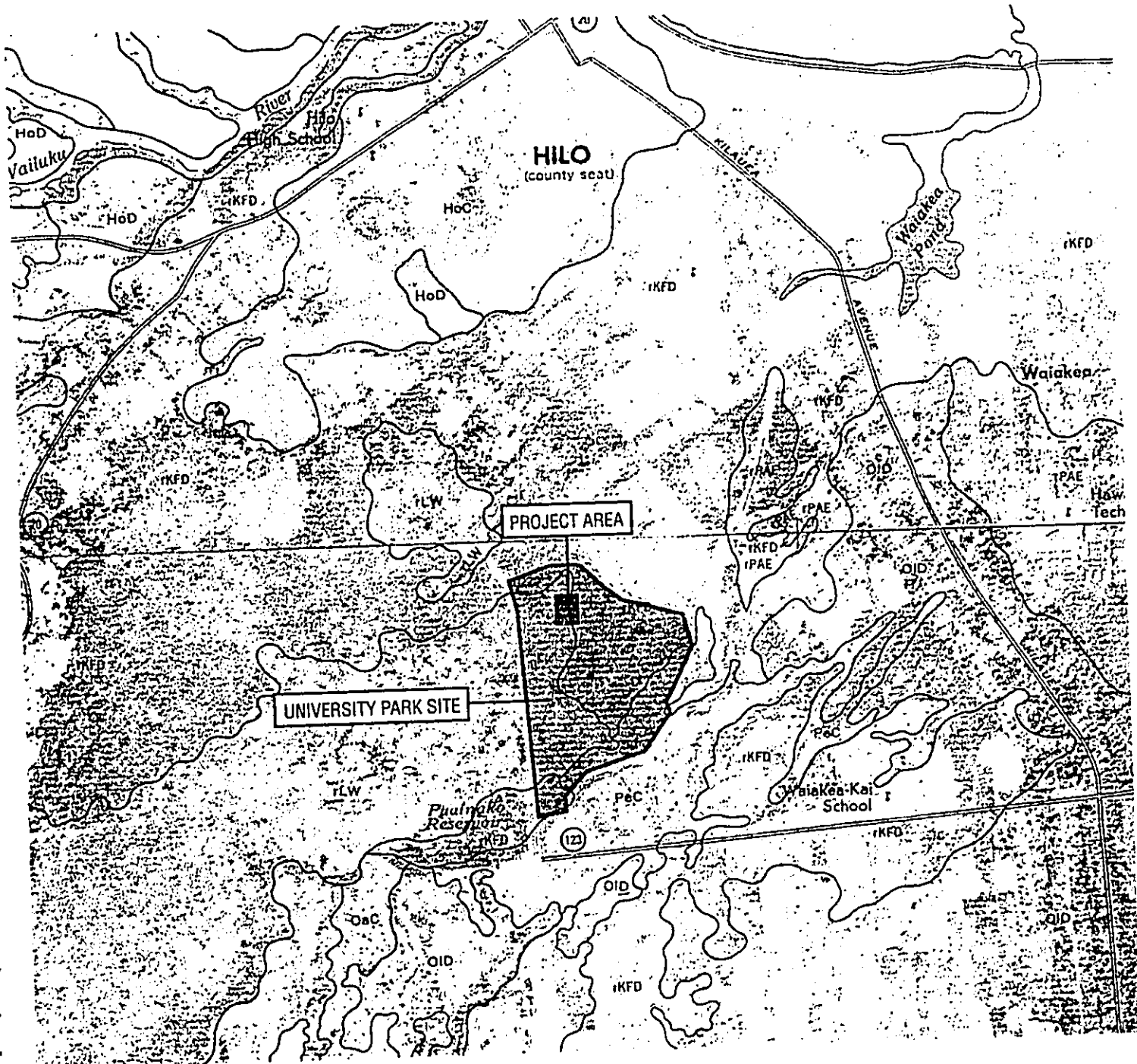
#### *Potential Impacts and Mitigative Measures*

The potential for soil erosion may increase during construction and decrease after development of the proposed project. Increase in soil erosion potential will result from removal of existing vegetation during the construction period. Possible degradation of water quality may result from runoff associated with erosion. The reduction in soil erosion potential expected after development will be due to the establishment of permanent landscaping, and increased impervious surfaces (buildings and pavement).

Geotechnical investigations have been conducted to verify soil types and the suitability for construction. Erosion control plans will be prepared for all construction work. The erosion control plan will identify specific best management practices (BMPs) which will be employed to minimize erosion and run off from the site. In addition, construction activities will be subject to conditions of the National Pollutant Discharge Elimination System (NPDES) permit for discharge of storm water associated with construction activities. Minimizing site erosion and associated sediment transport to state waters is a primary objective of this permit.

Proposed mitigation measures may include hydromulching with seeds or placement of erosion control matting to stabilize slopes and exposed surfaces, and construction of a graveled ingress/egress for use by construction vehicles at the entrance of the site to minimize the tracking of debris onto paved streets. Silt fences, berms, temporary siltation





**LEGEND**






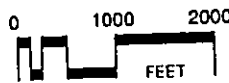
-  Project Area
-  University Park Site
-  Keaukaha Extremely Rocky Muck
-  Lava Flows, Pahoehoe
-  Panaewa Very Rocky Silty Clay Loam

FIGURE 4

SCS Soil Survey

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Source: USDA, Soil Conservation Service Soil Survey of Island of Hawaii, State of Hawaii

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basins and other means of protecting water quality may be employed to prevent direct discharge of sediment-laden storm runoff to municipal storm drains.

#### 4.1.4 Drainage

The proposed project is outside of any flood boundaries (see section 4.1.5), is not a shoreline property, and lies entirely outside of the coastal flood zone attributable to either high wave action or tsunami.

##### *Potential Impacts and Mitigative Measures*

Development will increase the percentage of impervious surfaces within the project site and thus increase the volume of storm runoff from the site. During construction, temporary siltation basins will be constructed to detain runoff and minimize sediment transport to off-site areas. After development, the drainage system will be designed to ensure no increase in runoff toward adjacent properties.

On-site measures will be employed to detain any increase in runoff due to development. Storm drain drywells and landscaping/grading to provide filtering and detention of runoff are mitigation measures that will be employed on a long-term basis.

#### 4.1.5 Natural Hazards

Hurricanes, tsunamis, earthquakes, and lava flows represent the major natural hazards on the island of Hawai'i. None of these natural hazards appear to be uniquely applicable to this site. The subject site is located more than two miles from the shoreline. As such, it would not be vulnerable to tsunamis.

According to the Flood Insurance Rate Map (FIRM), the subject site is designated Zone X, areas determined to be outside the 500-year flood plain (Figure 5). Thus, the subject site does not appear vulnerable to flooding.

The U.S. Geologic Survey report identifies the degree of volcanic hazard of this area to be "3" out of a scale of "9". The lower the number, the greater the degree of hazard. It should be noted that the entire city of Hilo has been designated Zone 3. In 1881, a historic lava flow from Mauna Loa flowed into Hilo within one mile of Hilo Bay.

##### *Potential Impacts and Mitigative Measures*

The proposed project will not exacerbate any hazard conditions. The potential impact of hurricanes and earthquakes will be mitigated by compliance with the County Building Code.

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#### 4.1.6 Flora

A walk-through field study of the subject parcel and the surrounding area's botanical resources was conducted by Char and Associates in November 1992. The results of this study are attached as Appendix A. The survey found the site to be characterized by ohia trees and matted uluhe ferns. Visual observation also indicates the presence of guava thicket. Based on the study, none of the plants inventoried were listed as threatened and endangered species; nor were any proposed as candidates for such status.

#### *Potential Impacts and Mitigative Measures*

Because the site contains no threatened and endangered plant species, development of the project site is not expected to have a significant impact on botanical resources. Native plants will be used for landscaping wherever possible, where feasible, existing vegetation will be incorporated into the landscape design.

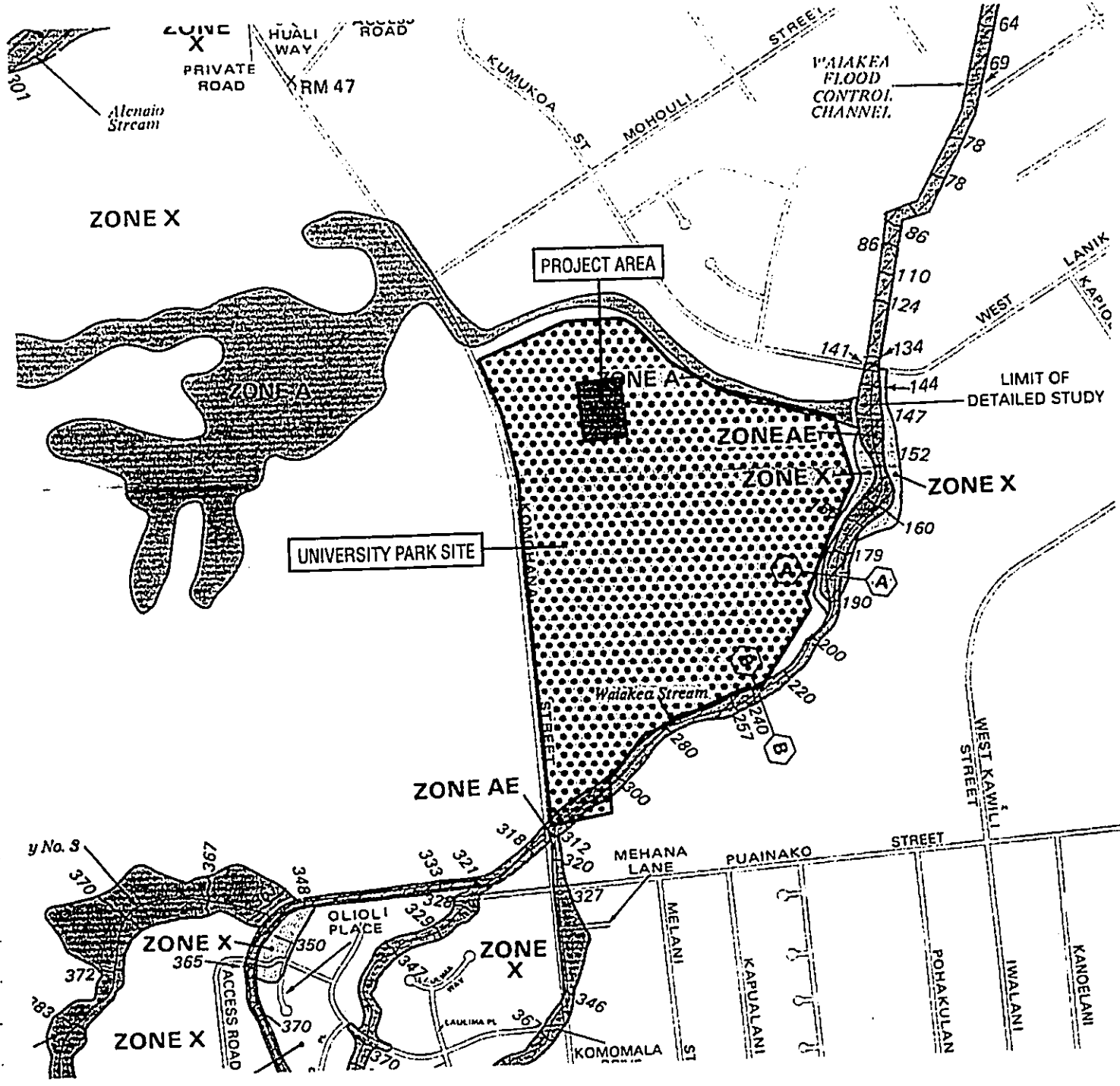
#### 4.1.7 Fauna

State-wide avifaunal surveys were conducted by the U.S. Fish and Wildlife Service (USFWS) from 1976 to 1983. However, no transects were counted through the University Park site since the habitat was considered almost completely alien, harboring few native forest bird species. The avifauna currently found below 500 feet in elevation in the Hilo area is dominated by introduced species. Two extant endemic avian species can be expected to occasionally be recorded within the University Park. One endangered and one threatened pelagic species may overfly the University Park occasionally between the months of April and October. These species are described below.

Hawaiian Hawk. The Hawaiian Hawk or Io (*Buteo solitarius*) is the only extant falcon form in Hawai'i; it currently is endemic to the Island of Hawai'i. Hawaiian Hawks occupy a wide variety of habitats; in fact they are to be found in almost all habitats with trees. Hawaiian Hawks have repeatedly been seen close to the University Park. It is probable that they occasionally forage within the University Park; however, there is little remaining tree cover suitable for nesting within the site.

Short-eared Owl. The Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) is a Hawaiian endemic subspecies of the widely distributed Short-eared Owl (*Asio flammeus*). The Pueo is ubiquitous on the island, being found in almost all habitats. Short-eared owls eat a diet of mice and small rats augmented by large insects and the occasional bird. It is probable that this species forages within the University Park at least occasionally.

Dark-rumped Petrel. The Dark-rumped Petrel or Uau (*Pterodrom aphaeopygia sandwichensis*) is endemic to Hawai'i at the subspecies level. This pelagic seabird was



- LEGEND**
- Project Area
  - University Park Site
  - Areas with no base flood elevations determined.
  - Areas within 100-year flood plain with base elevations determined.
  - Areas of 500-year flood; areas for 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.
  - Areas determined to be outside of the 500-year flood plain.

Source: Flood Insurance Rate Map #155166 0880 C

FIGURE 5  
 Flood Insurance Rate Map  
 SI/SMA Hilo Base Facility

0 500 1000 FEET

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formerly very common on the island, but has been listed as endangered since 1967. Seabirds are especially vulnerable to predation by terrestrial mammals. A secondary risk, especially to fledgling birds, is that they become disoriented by lights on their way to sea, causing them to collide with manmade structures. There is no suitable nesting habitat for this species within the University Park. However, it is probable that small numbers of this species occasionally fly over University Park on their way to nesting areas in the mountains between April and October.

Newell's Shearwater. Newell's Shearwaters or Ao (*Puffinus newelli*) were listed as threatened in 1975. It is probable that at least a few birds fly over University Park during the breeding season. This pelagic species nests high in the mountains in burrows excavated under thick vegetation, especially uluhe fern. Although there is no recent record of nesting Newell's Shearwaters in the immediate vicinity of the University Park, there are numerous records of this species being seen, heard or collected close to the Saddle Road. Newell's Shearwaters, like Dark-rumped Petrels, are extremely vulnerable to predation by terrestrial mammals and become disoriented by lights on their way to and from sea.

Given the fact that the avifauna of University Park is dominated by alien species, and that any usage of the site by endemic avian species is best described as incidental—no impacts are expected to native avian populations due to development.

*Mammals:*

With the lone exception of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) or Opeapea, all the terrestrial mammalian species currently on the island are alien species introduced by man. The mammalian species which may occasionally use the site include:

<u>Common Name</u>	<u>Scientific Name</u>
Hawaiian hoary bat	<i>Lasiurus cinereus semotus</i>
Norway rat	<i>Rattus norvegicus</i>
Roof rat	<i>Rattus rattus</i>
Polynesian rat	<i>Rattus exulans hawaiiensis</i>
European house mouse	<i>Mus domesticus</i>
Domestic dog	<i>Canis familiaris</i>
Small Indian mongoose	<i>Herpestes auropunctatus</i>
Cat	<i>Felis catus</i>
Pig	<i>Sus scrofa</i>

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*Potential Impacts and Mitigative Measures*

The proposed project should not have a significant negative impact to birds or introduced wildlife in the area. Some of the existing vegetation will be replaced by landscape improvements.

There have been only four comprehensive bat surveys conducted on the Island of Hawai'i. Two of these surveys addressed lands close to the University Park. Originally considered to be a distinct species, the Hawaiian hoary bat is now taxonomically classified as an endemic Hawaiian sub-species of the North American hoary bat. This bat is usually a solitary arboreal rooster and therefore, difficult to study. This species may use the University Park area at least occasionally. However, taking into consideration the current knowledge and understanding of the abundance, distribution, and biology of the Hawaiian hoary bat, it is unlikely that the proposed project will have a deleterious impact on the Hawaiian hoary bat.

## **4.2 HUMAN ENVIRONMENT**

### **4.2.1 Archaeological and Historic Resources**

An archaeological inventory survey of the University Park site was conducted from December 1992 to January 1993 by Cultural Surveys Hawai'i (Appendix B). This survey was done in conjunction with the processing of plans for the construction of on-site infrastructure improvements within the University Park site. The survey area covered 163 acres.

The report noted that bulldozing had occurred within the study area for an old water main and an electric power line. In addition, two structures (Agriculture Center and Joint Astronomy Center) and their associated parking lots and paved roadways were completed prior to the archaeological survey. Archaeological sites were located within the southern portion of the area, of which four were described and mapped. Two agricultural complex sites (18668 and 18669) and a mound feature of a third site (18667) were hand excavated and tested to document stratigraphy in the sites and to search for cultural remains to date the sites. No subsurface cultural deposits were found. Based on the type and age indicated by the data collected and analyzed, no further archaeological research was recommended.

In September 1993, a supplemental archaeological survey was done by Cultural Surveys Hawai'i (Appendix C), covering approximately 11 acres within the adjacent flood control channel east (makai) and adjacent of the subject parcel. During this survey, four (4) plantation-era (circa 1870 to 1940) rock clearance features or mounds and a portion of a rock wall continuing from the State-owned parcel were identified. These features were

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Included in the original survey under State Historic Site No. 50-10-35-18670. Based on subsurface testing of the largest mound within the flood control channel, and another mound located within the State-owned parcel, these features were determined to be part of the commercial sugar cane cultivation of the Waiakea Cane Lots. As such, no further archaeological research was deemed necessary.

*Potential Impacts and Mitigative Measures*

Because no significant archaeological resources are expected to be found in the area, no potential impacts are anticipated. However, all construction plans will include the following language as normally recommended by the State Historic Preservation Division:

Should historic remains such as artifacts, burials, concentrations of shell or charcoal be encountered during the construction activities, work shall cease immediately in the immediate vicinity of the find and the find shall be protected from further damage. The contractor shall immediately contact the State Historic Preservation Division at 692-8015 which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary.

**4.2.2 Roads and Traffic**

Komohana Street is a two-lane, county-owned roadway with an 80-foot right-of-way in the vicinity of the proposed improvements. It serves as one of several major cross-town roads. There is a left-turn storage lane along Komohana Street at its intersection with Nowelo Street. Nowelo Street serves as the University Park's entry from Komohana Street. Nowelo Street has been constructed to county dedicable standard and has a right-of-way of 60 feet with at least 20+ feet of pavement.

The subject site fronts North Aohoku Place. Access is planned from North Aohoku Place, a county-standard cul-de-sac road with a 50-foot right-of-way. North Aohoku Place intersects with Nowelo Street. Both North Aohoku Place and Nowelo Street roads are improved with curbs, gutters, and sidewalks. The utilities are also underground within the road right-of-way.

The overall road condition of Komohana Street, Nowelo Street, and North Aohoku Place conforms to county standards.

*Potential Impacts and Mitigative Measures*

Anticipated traffic for the facility should not be significant to warrant additional road improvements in this area. The project is expected to generate forty (40) jobs at the

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facility. It is estimated that at least thirty-six (36) employees will work during the day. Trip generations to and from the site should thus be slightly increased during a normal work day.

As access to the site is already via a county-standard road with a channelized intersection, coupled with a traffic signal light at the Komohana Street/Mohouli Street intersection, traffic movements to and from the site should not be significantly adverse. Thus, the traffic impacts resulting from the use of the proposed structure should not be significant.

Measures proposed to mitigate traffic impacts resulting from development of the project include:

Mitigation of Short-Term Construction Impacts. The contractor shall conform to the safety precautions and requirements of the Rules and Regulations Governing the Use of Traffic Control Devices at Work Sites on or Adjacent to Public Streets and Highways, adopted by the Highway Safety Coordinator, and the U.S. Federal Highway Administration's Manual on Uniform Traffic Control Devices for Streets and Highways, Part VI, Traffic Controls for Highway Construction and Maintenance Operations. Other conditions to be imposed on the contractor to minimize traffic disruptions include:

- (1) Access to and from driveways and public streets shall be provided at all times.
- (2) During non-working hours, any trenches shall be covered with steel plates and all lanes shall be open to traffic.
- (3) As required by the County of Hawai'i, special duty police officers shall be hired to direct the flow of traffic.
- (4) All walkways and intersections shall be maintained in passable condition for pedestrian traffic.

#### **4.2.3 Air Quality**

The State Department of Health (DOH) maintains a limited network of air monitoring stations around the state to gather data on certain regulated pollutants. Currently, no routine ambient air monitoring is conducted by DOH in the Hilo area. Historical monitoring during the 1970's and 1980's indicated very low pollutant levels in Hilo and there is little reason to believe this has changed significantly.

While air quality in the Hilo area is very good for the most part, period degradation occurs naturally due to the active volcano, Kilauea, located almost directly south of Hilo. This



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degradation occurs under southerly or "kona" wind conditions when plumes from the volcanic vents are carried toward Hilo.

For volcanic fog (vog) to significantly impact the Hilo area, however, two conditions must prevail: 1) the winds must be southerly (or kona), and 2) the volcano vents must be active. Since winds from the south occur approximately 7 percent of the time, long-term impacts should be prefaced by the caveat that such impacts are based on intermittent, not continuous, exposure.

During two 12-month periods of monitoring in Hilo sulfate concentration, which is the best indicator of the presence of vog, averaged 1 to 2 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ), but showed occasional peak values as high as  $15 \mu\text{g}/\text{m}^3$  (J. W. Morrow, et al.). During the sampling years, there were four to five sampling days in which 24-hour concentrations were  $\geq 5 \mu\text{g}/\text{m}^3$ .

Since the sampling schedule was once every three days, this would suggest that total "high" days might have reached twelve to fifteen days per year if monitoring occurred every day. This equates to 3 to 4 percent of the time, which is somewhat less than the 7 percent of the time associated with wind direction alone.

On-site carbon monoxide sampling was conducted by J. W. Morrow in February 1997 in the vicinity of the Puainako/Komohana and Lanikaula/Kinoole intersections. These sites were selected based on the results of a traffic impact study which indicated higher traffic volumes and potentially significant impacts at these intersections.

#### *Potential Impacts and Mitigative Measures*

The project will generate more trips to and from the site on a daily basis. These trips will essentially be split between the morning and afternoon work hours, although there may also be about six to ten non-employee trips to the site daily. Given the usual tradewind patterns, the projected volume of vehicles generated by this project, and cars now being equipped with higher vehicular emission control systems, the impact to the existing ambient air quality should not be significant.

Construction activity will be the principal source of short-term air quality impact. Construction vehicle activity will increase automotive pollutant concentrations along the existing roadways as well as on the project site. Site preparation, earth moving, and building and road construction will create particulate emissions. Movement of construction vehicles on unpaved surfaces will also generate particulate emissions.

Studies by the EPA on fugitive dust emissions from construction sites indicate that about 1.2 tons per acre per month of activity may be expected under conditions of medium

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activity, moderate soil silt content (30 percent) and a precipitation/ evaporation (P/E) index of 50. While some on-site soils are silty clay loams with a substantially higher silt content than the "moderate" silt content in the EPA studies, the wet local climate (P/E index of 213) would more than offset this, thus suggesting a much lower fugitive dust emissions than estimated by EPA. The predominance of low wind speeds also suggests reduced fugitive dust potential.

In addition, there will be off-site impacts due to the operation of concrete batching plants needed for construction. Such plants routinely emit particulate matter and other gaseous pollutants. The batch plants must be permitted by the State Department of Health Clean Air Branch, and must demonstrate their ability to continuously comply with both emission and ambient air quality standards.

No exceedance of state or federal carbon monoxide standards are anticipated. Concentrations will increase with or without the project due to increased traffic volumes, reduced average speed, and queuing at signalized intersections.

Although the potential for fugitive dust seems low due to the wet climate and low wind speeds, adequate dust control will be employed, particularly during dry periods. Dust control will be accomplished by frequent watering of unpaved roads and areas of exposed soil surfaces. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50 percent. Accelerated landscaping of completed areas will also be employed. Dust control should be implemented as required based on weather conditions.

The off-site impacts associated with preparation of construction materials will be controlled by the existing regulatory requirements for air pollution sources which will ensure compliance with health and environmental standards. The corrosive nature of the climate will be a consideration in the design of buildings and facilities.

#### **4.2.4 Noise**

There are no residences proximate to the site. Surrounding land uses are similar to the project, i.e., other telescope base facilities. Generally, noise in this area is associated with traffic from Komohana Street.

##### *Potential Impacts and Mitigative Measures*

The project's noise impact should not affect the ambient noise level. When completed, the project's noise impact should be negligible, except for noise associated by vehicles frequenting the site. An air compressor and an air conditioning unit will be enclosed within a mechanical room.

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There will be a short-term noise impact associated with the construction of the project during normal working construction hours. Adverse impacts from construction noise are not expected to affect public health and welfare.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50-foot distance), and due to the exterior nature of the work (e.g. rock breaking, grading and earth moving, trenching, concrete pouring, hammering).

Compliance with State Department of Health construction noise limits and curfew times, which are applicable on the Island of Hawai'i, is the primary noise mitigation measure that will be employed. Construction activities will be in compliance with the provisions of Hawai'i Administrative Rules, Chapter 11-46, "Community Noise Control":

- The contractor will obtain a noise permit if the noise levels from the construction activities are expected to exceed the allowable levels of the regulations as stated in Section 11-466(a);
- Construction equipment and on-site vehicles requiring an exhaust of gas or air will be equipped with mufflers as stated in Section 11-46-6(b)(1)(A);
- No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays as stated in Section 11-467(3); and
- The contractor must comply with the conditional use of the permit as specified in the regulations and conditions issued with the permit as stated in Section 11-46-7(d)(4).
- The contractor shall also comply with County noise regulations, including those specified in the grading permit.

#### **4.2.5 Visual Resources**

The site is mostly not visible for Komohana Street, the major roadway in the area. The project site is located on the makai, or ocean side of North Aohoku Place. Opposite the project site is the Joint Astronomy Center and the Subaru National Astronomical Observatory of Japan. Between these buildings and Komohana Street is a buffer area containing overgrown vegetation which effectively screens views into University Park, except for a chained-off roadway that provides a break on the north edge of the Joint Astronomy center.

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*Potential Impacts and Mitigative Measures*

The proposed building will be designed to be compatible with the character of the surrounding area and will be landscaped in keeping with the character of the University and of Hilo Town. The structure will be about 35 feet high, which is the height limit within the RS zoning district. In addition, the view from the project site is not listed as a critical viewplane in any of the County's published planning documents, the General Plan, or Hilo Community Development Plan.

**4.2.6 Social and Employment Characteristics**

Construction of the facility will not require the relocation of residents, as the site is currently vacant. Short-term construction employment benefits will be generated throughout the two phases of work; there will be longer-term employment for the estimated forty employees.

**4.2.7 Economic Factors/Government Revenues**

Estimated annual income expected to be generated for the County of Hawai'i is \$5 million, exclusive of the construction activities.

The proposed action is not expected to significantly affect surrounding land values.

**4.2.8 Infrastructure**

**4.2.8.1 Water System**

There is an existing 12-inch County water line along Komohana Street. This 12-inch line has been extended to Nowelo Street and North Aohoku Place, fronting the subject site. Potable county water is thus available for the proposed use.

**4.2.8.2 Wastewater System**

There is an existing eight-inch sewer line within Nowelo Street and North Aohoku Place up to the subject site. This line connects to the University system; and the University's system is tied into two lines—one is a 12-inch line along Kawili Street and the other a 10-inch line along Lanikaula Street. The project will tie into a sewer line along the access road to the east, downhill of North Aohoku Place via gravity feed.

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4.2.8.3 Drainage System

The subject site (designated Zone X on the Flood Insurance Rate Map (FIRM)) is in an area of minimal flooding and/or drainage hazards (Figure 5). The proposed parking area should increase the area of semi-impervious surface, and the structure's roof should also add to the increase of on-site drainage. However, given the existing permeable condition of the land and the construction of County-approved drywells and related on-site drainage systems, on- and off-site drainage problems associated with this project are not anticipated.

4.2.8.4 Solid Waste

The proposed use should not generate a significant amount of waste. Generated waste will be hauled by commercial haulers to the County's landfill. As may be needed, any hazardous waste (such as oil) associated with the project will be disposed of in a manner consistent with the appropriate Federal, State, and County disposal requirements.

4.2.8.5 Electrical/Telephone

Electrical and telephone services are currently sized, adequate, and available to supply the area and parcel.

**4.2.9 Public Services**

4.2.9.1 Police Protection Services

The project site is located in South Hilo, Patrol District 1. The district extends from Hakalau in the north, to the mid-point of Kanoelehua Avenue between Hilo and Kea'au in the south, to the Saddle Road in the west. The district includes the main police station, located at 349 Kapi'olani Street, approximately five minutes travel time from the project site. More than half of the district's patrol officers are assigned to the City of Hilo.

4.2.9.2 Fire Protection Services

The project site is served by the Kawaiiani Fire Station located at 411 Kawaiiani Street. Backup service would be provided by the Central Fire Station, located at 466 Kinoole Street. Travel time from each station to the project site is three to five minutes. Additional backup would be provided by the Waiakea Rescue Station and the Kaumana Station with its HAZMAT team, which would be used in unlikely event of a chemical spill.

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4.2.9.3 Medical Services

Hilo Hospital is the major medical facility in the vicinity of the project site. The hospital, located at 1190 Waiānūenue Avenue, is approximately 10 minutes travel time from the project site. Ambulance service in Hilo is provided by the Hawai'i Fire Department, which can serve the project site from the Central Fire Station in three to five minutes.

4.2.9.4 Recreational Facilities

The entire South Hilo District contains 54 parks totaling 590 acres. The immediate area of the project site is served by two neighborhood parks, including University Heights Park and Mohouli Park. Both parks are located within walking distance of the UH Hilo campus. The existing campus contains approximately 15 acres of recreational facilities used for basketball, baseball, tennis, volleyball and soccer. It is anticipated that sufficient recreational facilities exist and/or are planned to serve the projected daytime (working) population increase due to the proposed project.

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## 5.0 ALTERNATIVES TO THE PROPOSED ACTION

In compliance with the provisions of Title 11, Department of Health, Chapter 200, Environmental Impact Statement Rules, Section 11-200-17(f), the "known feasible" alternatives to the proposed project are limited to those that would allow the objectives of the project to be met, while minimizing potential adverse environmental impacts. As such, the proposed project has been evaluated in terms of the following.

### 5.1 NO ACTION ALTERNATIVE

A "no action" decision would result in the loss of an economic addition to the Hilo area, as this facility and its support staff could contribute approximately \$5 million annually to the island's economy.

No action could also diminish the University's efforts to create a viable research park that can also be supportive of the University. As the observatory is already under construction on the summit of Mauna Kea, a base facility—such as the one being proposed—is already needed. Thus, whether the facility is located in Hilo or other parts of the island, it still will be needed.

### 5.2 OTHER ALTERNATIVES

The location of the facility and staff close to an area with related research and technical facilities (University of Hawai'i at Hilo, Gemini, the Joint Astronomy Center, CALTECH, and NAOJ-Subaru) will provide immediate resources for this project.

While alternate sites on this island could have been considered, those alternate sites would not provide immediate and continuous resources of scientific nature for the facility staff. Also, an alternate site, such as Waimea, may present higher costs than Hilo since the University Park site is already developed with off-site infrastructure. Further, Kona International Airport is not as conveniently located to Waimea as Hilo Airport is to the project site.

The availability of public services, good on- and off-site infrastructure, and the site's proximate location to the University, community, and other astronomy-related facilities are positive factors for the proposed location of the base facility.

Fulfillment of the University's research and technology park plans could provide a catalyst for an academic landmark for astronomy and a resource for economic diversity in South Hilo.

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## 6.0 DETERMINATION, FINDINGS, AND REASONS FOR SUPPORTING DETERMINATION

To determine whether the proposed action may have a significant impact on the environment, expected consequences, both primary and secondary, and the cumulative as well as short-and long-term effects have been evaluated. Based on the analysis performed and the research evaluated, the Accepting Authority (University of Hawai'i at Hilo, Vice Chancellor of Administrative Affairs) has issued a finding of no significant impact (FONSI).

### 6.1 SIGNIFICANCE CRITERIA

According to the Department of Health Rules (11-200-12), an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences both primary and secondary, its cumulative impact with other projects, and its short and long-term effects. In making the determination, the Rules establish "Significance Criteria" to be used as a basis for identifying whether significant environmental impact will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any one of the following criteria:

- (1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;

No endangered plant or animal species are known to exist on the property. The project will be designed in compliance with all federal, state, and county laws regarding drainage and non-point source pollution.

Based on analysis of previous archaeological studies and surveys, no significant archaeological resources are expected to be found in the area. If, however, archaeological resources are discovered, work will cease and the State Historic Preservation Division will be contacted to assess the significance of the find and to recommend appropriate mitigation measures.

Therefore, based on the above, it is expected that there will be no irrevocable commitment to loss or destruction of any natural or cultural resources.

- (2) Curtails the range of beneficial uses of the environment;

The entire surrounding area has been planned for use as a technology park and environmental impacts were addressed in a Final EIS (*Final Environmental Impact Statement for the University of Hawai'i at Hilo University Park, Hilo, Hawai'i, TMK: 2-4-*

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01:7, 12, 19, 41 and 2-4-03: 26, September 1997) which was accepted in 1997. As such the proposed project will not interfere with surrounding uses and will complement and enhance the proposed uses of the area.

Except during construction, anticipated related noise and vehicular impacts should be negligible. Drainage and wastewater will be handled in a manner meeting with the all Federal, State, and County requirements. Thus, the proposed facility is not expected to curtail the range of beneficial uses of the surrounding environment.

- (3) Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS; and any revisions thereof and amendments thereto, court decisions, or executive orders;

The proposed project is consistent with the Environmental Policies established in Chapter 344, HRS and the National Environmental Policy Act.

- (4) Substantially affects the economic or social welfare of the community or state;

The proposed project is expected to generate an estimated annual income for the County of Hawai'i of approximately \$5 million, exclusive of construction activities. Additional benefits include the employment of approximately 40 persons. As the site is currently vacant and planned for technology related uses, no negative economic or social impacts are expected from the proposed project.

- (5) Substantially affects public health;

Impacts to public health may be temporarily affected by air and noise impacts during construction, however, these will be of a short-term duration, and insignificant, especially when weighed against the positive economic, social, and quality of life benefits associated with the project.

- (6) Involves substantial secondary impacts, such as population changes or effects on public facilities;

The requested use is part of the University's plans to implement a research and technology park in this area. This park and the growth implications were considered by the State's previous action of creating this park and the construction of the required on-site infrastructure (*Final Environmental Impact Statement for the University of Hawai'i at Hilo University Park, Hilo, Hawai'i, TMK: 2-4-01:7, 12, 19, 41 and 2-4-03: 26, September 1997*).

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- (7) Involves a substantial degradation of environmental quality;

While the land will be cleared for the proposed improvements, landscaping will be provided in selected areas to minimize the impact.

Appropriate best management practices will provide safeguards for protection of water and air quality during the short-term construction period.

- (8) Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;

The proposed project will not have a cumulative negative effect on the environment. The project is consistent with the urban uses designated for the State Land Use Urban District, and is also consistent with the Hawai'i General Plan. As such, the project is a well thought-out improvement that is not expected to have undesirable cumulative effects. The commitment of fiscal resources to construct the project, however, will foreclose other uses of those resources.

- (9) Substantially affects a rare, threatened or endangered species or its habitat;

The U.S. Fish and Wildlife Service conducted state-wide avifaunal surveys from 1976-1983, however, no transects were counted through the University Park since the habitat is considered almost completely alien. While it is possible that endangered or threatened avifaunal species may overfly the Park on their way to nesting areas or forages within the University Park, there is no suitable nesting habit for the species within the park and therefore the proposed improvements should not substantially affect these species.

A field study of the subject parcel's botanical resources found there were no endangered or threatened flora species found on the site.

- (10) Detrimentially affects air or water quality or ambient noise levels;

The only discernible air quality impacts associated with the proposed facility would be from the vehicular traffic. The frequency and volume of traffic generated by this project, however, will be insignificant. Thus the impacts should not be substantial.

Like the air quality impact, possible noise impacts would be attributable to the vehicular traffic. Traffic would not be as high as a commercial area, but more in the pattern of a business office. Thus the noise ambient level should not be significantly affected.

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The effect of the project on water quality will be mitigated by the use of best management practices (BMPs) during construction. Minimal impacts on air quality and noise are anticipated during construction. In addition, the drainage system will be designed to ensure no increase on runoff toward adjacent properties.

- (11) Affects or is likely to suffer damage by being located in an environmentally sensitive area, such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, freshwater, or coastal waters.

The proposed project is not located in an environmentally sensitive area. Flood Insurance Rate Maps place the subject outside of the 500-year flood zone and it is not likely that the proposed improvements would suffer damage from tsunami inundation, as the site is located more than a mile inland.

- (12) Substantially affects scenic vistas and view planes identified in county or state plans or studies;

The proposed project is not listed as a critical view plane in any of the county's published planning documents, the General Plan, or Hilo Community Development Plan.

- (13) Requires substantial energy consumption.

Construction of the proposed improvements will increase energy consumption due to the increase in population and facilities; however, the increase is not expected to exceed the requirements of other similar facilities. The project will be subject to the provisions of the energy section of the Hawai'i County Building Code. During the design phase, appropriate mitigation measures will be considered to reduce energy consumption over and above code requirements.

## **6.2 DETERMINATION**

On the basis of the above criteria, and the discussion of impacts and mitigative measures contained in this document, and the public agency and community comments received in the review of the Draft EA, the Accepting Authority (University of Hawai'i at Hilo, Vice Chancellor of Administrative Affairs ) of this Environmental Assessment has determined that the proposed Smithsonian Astrophysical Observatory SMA Hilo Base Facility will have no significant environmental effects. Pursuant to Chapter 343, Hawaii Revised Statutes, the Accepting Authority has issued a Finding of No Significant Impact (FONSI).

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7.0 REFERENCES

- Engineering Concepts, Inc., *Environmental Assessment for the University of Hawai'i at Hilo Infrastructure for Research and Technology Lots, Hilo, Hawai'i, TMK: 2-4-01:7 and 41, November 1993.*
- Engineering Concepts, Inc., *Final Environmental Impact Statement for the University of Hawai'i at Hilo University Park, Hilo, Hawai'i, TMK: 2-4-01:7, 12, 19, 41 and 2-4-03: 26, September 1997.*
- Engineering Concepts, Inc., *Preliminary Engineering Report for the Proposed UH Hilo University Park, Hilo, Hawai'i, November 1993.*
- Group 70 International, Inc., *Final Environmental Impact Statement and Site Selection Study for Hilo Judiciary Complex, South Hilo District, Island of Hawai'i, prepared for State of Hawai'i Department of Accounting and General Services, February 1997.*
- Morrow, J. W., E. J. Morgan, A. N. Furuike, "Characterization of Volcanic Aerosol in Two Populated Areas on the Island of Hawai'i: First Year Findings of a 3-Year Investigation," Paper No. 91-89.2, Air & Waste Management Association Annual Meeting, Vancouver, B. C., June 1991.
- Morrow, J. IV., and A. N. Kodama, "Characterization of VOG and LAZE in Three Communities on the Island of Hawai'i, 1 Oct 90 - 30 Sep 91, Summary Report," 1 July 1994.
- Morrow, J.W. "Air Quality Impact Report University of Hawai'i at Hilo University Park, 10 March 1997," in Engineering Concepts, Inc., *Final Environmental Impact Statement for the University of Hawai'i at Hilo University Park, Hilo, Hawai'i, TMK: 2-4-01:7, 12, 19, 41 and 2-4-03: 26, September 1997.*
- Okahara and Associates, Inc., "Revised Environmental Impact Statement Notice of Preparation for Puainako Extension and Widening, South Hilo, Island of Hawai'i," July 14, 1995.
- PBR HAWAII and Kajjoka Okada Yamachi Architects, *University of Hawai'i at Hilo, Long Range Development Plan, March 1996.*
- R. M. Towill Corporation, *Final Environmental Assessment for Hilo Scattered Lots Residential Development, Hilo, Island of Hawai'i, State of Hawai'i, prepared for State of Hawai'i Department of Hawaiian Home Lands, September 1992*

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U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Island of Hawai'i, State of Hawai'i*, December 1973.

U.S. Department of Transportation Federal Highway Administration, State of Hawai'i Department of Transportation Highways Division, and County of Hawai'i Department of Public Works, *Environmental Assessment for Mohouli Street Extension, Komohana Street to Kaumana Drive, South Hilo, Hawai'i*, September 1997.

Wilson Okamoto & Associates, Inc. in cooperation with Megumi Kon, Incorporated, *Research & Technology Park Conceptual Master Plan for the University of Hawai'i at Hilo*, May 1986.

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## 8.0 COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL ASSESSMENT

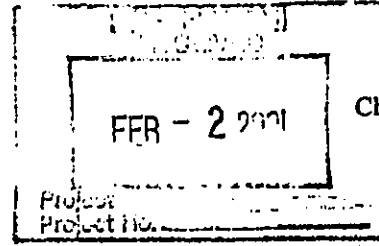
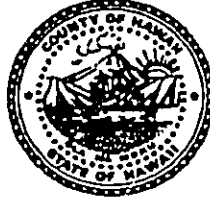
As required by the Office of Environmental Quality Control, copies of the Draft Environmental Assessment were provided to the following agencies and organizations. Where indicated the agency, organization, or individual submitted comments.

	Agency	DEA Mail Date	Date of Comments
	<b>STATE</b>		
1	Office of Environmental Quality Control	1/08/01	2/07/01
	<b>COUNTY OF HAWAII</b>		
2	Planning Department	1/08/01	1/25/01
	<b>LIBRARIES AND DEPOSITORIES</b>		
3	Hilo Public Library	1/08/01	

The following pages contain comment letters received and applicable responses.

1857.01\FINALEA

Harry Kim  
Mayor



Christopher J. Yuen  
Director

January 25, 2001

## County of Hawaii

### PLANNING DEPARTMENT

25 Aupuni Street, Room 109 • Hilo, Hawaii 96720-4252  
(808) 961-8288 • Fax (808) 961-8742

Mr. Tom Schnell  
PBR Hawaii  
Pacific Tower, Suite 650  
1001 Bishop Street  
Honolulu, HI 96813

Dear Mr. Schnell:

**Comments on the Preparation of a Draft Environmental Assessment  
Project: Smithsonian Astrophysical Observatory SMA Hilo Base Facility  
TMK: 2-4-1: Por. 7**

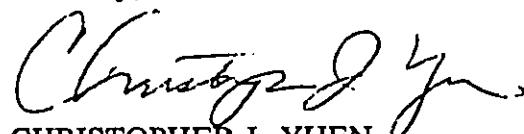
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Thank you for your memo dated January 5, 2001, requesting comments regarding the preparation of a draft environmental assessment for the proposed Smithsonian Astrophysical Observatory SMA Hilo Base Facility project. We have the following comments to offer:

1. The project is located on lands designated Urban by the State Land Use Commission.
2. The property is situated within the County's Single Family Residential (RS-10) zoned district and is designated University Use by the Hawaii County General Plan LUPAG Map.
3. The project is not located within the County's Special Management Area (SMA).

If you have any questions, please call Phyllis Fujimoto of this office at 961-8288.

Sincerely,

  
CHRISTOPHER J. YUEN  
Planning Director

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p:\wpwin60\phyllis\LSmithastro01.doc

cc: Ms. Genevieve Salmonson, Office of Environmental Quality Control





LAND PLANNING  
LANDSCAPE ARCHITECTURE  
ENVIRONMENTAL STUDIES

February 7, 2001

Christopher J. Yuen, Planning Director  
County of Hawaii Planning Department  
25 Aupuni Street, Room 109  
Hilo, Hawaii 96720-4252

**SUBJECT: RESPONSE TO COMMENTS ON THE SMITHSONIAN ASTROPHYSICAL  
OBSERVATORY SMA HILO BASE FACILITY DRAFT ENVIRONMENTAL  
ASSESSMENT TMK: 2-4-1: POR. 7**

We have reviewed your letter dated January 25, 2001, regarding the Draft Environmental Assessment for the Smithsonian Astrophysical Observatory SMA Hilo Base Facility. We acknowledge that:

1. The project is located on lands designated Urban by the State Land Use Commission;
2. The property is situated within the County's Single Family Residential (RS-10) zoned district and is designated University Use by the Hawaii County General Plan LUPAG Map; and
3. The project is not located within the County's Special Management Area (SMA).

Thank you for participating in the environmental review process.

Sincerely,

PBR HAWAII

Tom Schnell, AICP  
Planner

cc: Office of Environmental Quality Control  
UH Hilo Vice Chancellor of Administration, Mr. John Whittaker

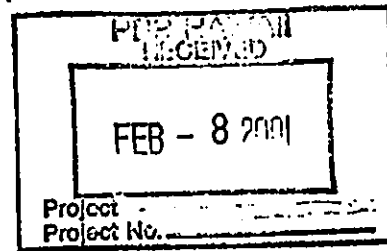
Wm. Frank Brandt • Thomas S. Wilton • E. Steve Duncan • Russell J. Clough **1857.01/comment letters/county planning**

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BENJAMIN J. CAYETANO  
GOVERNOR



GENEVIEVE SALMONSON  
DIRECTOR

STATE OF HAWAII  
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

235 SOUTH BERETANIA STREET  
SUITE 702  
HONOLULU, HAWAII 96813  
TELEPHONE (808) 586-4186  
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February 7, 2001

Mr. John Whittaker, Vice Chancellor  
Administrative Affairs  
University of Hawai'i at Hilo  
200 W. Kawili Street  
Hilo, Hawai'i 96720-7750

Dear Mr. Whittaker:


Subject: Draft Environmental Assessment for the Smithsonian Astrophysical Observatory  
SMA Hilo Base Facility, Hawai'i

Thank you for the opportunity to review the subject document. We have the following questions and comments.

1. This project should comply with sections 103D-407 and 408 of Hawaii Revised Statutes concerning the use of indigenous plants and recycled glass.
2. Please list all federal, state and county permits that would be required for this project.
3. Please consider applying sustainable building techniques as presented in the enclosed "Guidelines for Sustainable Building Design in Hawaii." In the final EA include a description of any of the techniques you will implement.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

  
Genevieve Salmonson  
Director

c: PBR Hawaii



LAND PLANNING  
LANDSCAPE ARCHITECTURE  
ENVIRONMENTAL STUDIES

February 7, 2001

Genevieve Salmonson, Director  
State of Hawaii  
Office of Environmental Quality Control  
236 S. Beretania Street, Suite 702  
Honolulu, Hawaii 96813

SUBJECT: RESPONSE TO COMMENTS ON THE SMITHSONIAN ASTROPHYSICAL  
OBSERVATORY SMA HILO BASE FACILITY DRAFT ENVIRONMENTAL  
ASSESSMENT TMK: 2-4-1: POR. 7

We have reviewed your letter dated February 7, 2001, regarding the Draft Environmental Assessment for the Smithsonian Astrophysical Observatory SMA Hilo Base Facility. We offer the following responses to your comments:

1. Although not a state or county project, and thus not affected by sections 103D-407 and 408, HRS, crushed glass aggregate for road surfaces may be considered in the project if appropriate and available. Also, project landscaping will include indigenous plants.
2. The federal, state, and county permits that are required for this project have been added to the Final EA, Section 3.2.4. The permits include a Grading Permit, Drainage Permit, and NPDES Permit.
3. The project will employ many of the sustainable building techniques presented in the OEQC's "Guidelines for Sustainable Building Design in Hawaii," including:
  - ◇ Siting building(s) to take advantage of natural features and maximize their beneficial effects,
  - ◇ Minimize the disruption of site drainage pattern,
  - ◇ Incorporate daylighting controls and/or motion activated light controls in low or intermittent use areas,
  - ◇ Exceed the State of Hawaii Model Energy Code requirements,
  - ◇ Use renewable energy. Use solar water heaters and consider the use of photovoltaics and Building Integrated Photovoltaics,

Wm. Earl Brandt • Thomas S. Wilton • R. Stan Duncan • Rossella J. Chung

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TELEPHONE: 508-962-3333 FAX: 508-962-1989

Genevieve Salmonson, Director

Office of Environmental Quality Control

SUBJECT: RESPONSE TO COMMENTS ON THE SMITHSONIAN ASTROPHYSICAL  
OBSERVATORY SMA HILO BASE FACILITY DRAFT ENVIRONMENTAL ASSESSMENT

TMK: 2-4-1: POR. 7

February 7, 2001

Page 2

- ◇ Use durable products, preferably locally produced,
- ◇ Use separate HVAC systems to serve areas that operate on widely differing schedules and/or design conditions, and
- ◇ Installing water conserving, low flow fixtures as required by the Uniform Plumbing Code.

The use of these design techniques will be noted in the Final EA, section 2.4.

Thank you for participating in the environmental review process.

Sincerely,

PBR HAWAII



Tom Schnell, AICP  
Planner

cc: Office of Environmental Quality Control  
UH Hilo Vice Chancellor of Administrative Affairs, Mr. John Whittaker

1857.01/comment letters/oeqc

BOTANICAL RESOURCES ASSESSMENT STUDIES

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**Appendix A**

BOTANICAL SURVEY  
UNIVERSITY OF HAWAI'I - HILO  
PROPOSED INFRASTRUCTURE FOR RESEARCH AND TECHNOLOGY LOTS  
SOUTH HILO DISTRICT, ISLAND OF HAWAI'I

by

Winona P. Char  
CHAR & ASSOCIATES  
Botanical Consultants  
Honolulu, Hawai'i

Prepared for: ENGINEERING CONCEPTS, INC.

December 1992

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BOTANICAL SURVEY  
UNIVERSITY OF HAWAI'I - HILO  
PROPOSED INFRASTRUCTURE FOR RESEARCH AND TECHNOLOGY LOTS  
SOUTH HILO DISTRICT, ISLAND OF HAWAI'I

INTRODUCTION

The proposed infrastructure for research and technology lots is located within a 116 acre State-owned parcel. The parcel is bounded by Komohana Road to the west, the Wailoa River and the existing University of Hawai'i Hilo (UHH) campus to the east and south, and a small, unnamed stream to the north. An existing 50-foot wide electrical easement runs through the property, roughly in a mauka-makai direction. Portions of the property are currently in use by the UH Agriculture Center (8.0 acres) and by the Joint Astronomy Center (JAC) Facility (4.4 acres). In addition, parts of the main access road (Road "A") and the road below the JAC facility (Road "B") have already been constructed.

Field studies to assess the botanical resources found on the project site were conducted on 06-07 November 1992; a total of three botanists were used for the field studies. The primary objectives of the survey were to: 1) provide a description of the general vegetation types; 2) compile an inventory of the flora; and 3) search for threatened and endangered plant species protected by Federal and State laws.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Topo-



graphic maps, the preliminary lot layout map, and soil maps (overlay of soil types on a photobase) were examined to determine access, boundaries, reference points, terrain characteristics, and vegetation cover patterns.

The less disturbed areas, which are more likely to harbor native plant communities, and, perhaps, rare plants were more intensively surveyed. The electrical easement served as the primary access; from the easement a number of surveyor's transects and long overgrown trails can be found.

A walk-through (pedestrian) survey method was used. Notes were made on plant associations and distribution, substrate types, topography, exposure, drainage, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium (UH, Manoa - HAW) and for comparison with the most recent taxonomic treatment of the flora.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions at the time of the survey. A survey taken at a different time and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the weedy, annual plants.

#### DESCRIPTION OF THE VEGETATION

To our knowledge, there have been no detailed botanical reports dealing specifically with the project site. A short, but incomplete list of the "predominant flora" was compiled for the University of Hawaii Hilo Long Range Development Plan (State of Hawai'i 1977).

The mauka (west) half of the project site, along Komohana Road,

is mapped as "rLW", pahoehoe lava flow (Sato et al. 1973), although, in places, there are jumbled heaps of 'a'a lava outcroppings. This flow is part of the 1881 Mauna Loa flow (Macdonald and Abbott 1970). Along the northern and central portion of the site, the substrate is mapped as "rKFD", Keaukaha extremely rocky muck, 6 to 20% slopes (Sato et al. 1973). This consists of well-drained, thin organic soils overlying pahoehoe lava bedrock. Both the 1881 flow and the Keaukaha soil series support a native-dominated forest of 'ohi'a trees and dense, matted uluhe ferns. Along the south and eastern portion of the site, the substrate is mapped as "PeC", Panaewa very rocky silty clay loam, 0 to 10% slope (Sato et al. 1973). This is a moderately well-drained, dark brown silty clay loam over pahoehoe bedrock; the depth to pahoehoe bedrock ranges from 15 to 20 inches. The vegetation on this soil series is composed largely of introduced species, mostly secondary forest trees, and the area appears to have been cultivated. There are a number of rock terraces and other features on this part of the site.

More detailed descriptions of the 'ohi'a-uluhe forest and the introduced mixed forest are presented below. All the plants inventoried during the field studies are presented in the checklist at the end of this report.

#### 'Ohi'a-Uluhe Forest

The 'ohi'a-uluhe forest occurs on wetter areas of the island, on both 'a'a and pahoehoe substrates. Its general physiognomy is of widely spaced 'ohi'a trees (Metrosideros polymorpha) within an almost continuous mat of uluhe fern (Dicranopteris linearis).

There are three variants of this vegetation type on the project site. On the relatively younger 1881 Lava Flow, around the JAC facility and the Agriculture Center, the forest is typical of the

earlier stages of succession. The majority of the 'ohi'a trees are of about even age and size, ranging from 15 to 25 ft. tall. The uluhe fern is very dense and forms an almost impenetrable mat between the trees, varying in height from 6 to 9 ft.; in places where the fern has climbed onto the trees, the tangled mats can be 12 ft. high. Because the uluhe cover is so dense, there are few other smaller species. Occasionally, a few plants of melastoma (Melastoma candidum), bamboo orchid (Arundina graminifolia), and strawberry guava (Psidium cattleianum) may be observed.

Where the forest occurs on the somewhat geologically older flow which has been mapped as "rKFD", Keaukaha rocky muck, the uluhe mat becomes patchy. Hala or pandanus (Pandanus tectorius) is frequently observed; if left undisturbed, the next step in natural succession would probably be to an 'ohi'a-hala dominated forest. However, the forest in this area supports a number of introduced species. Some fairly large-sized thickets of strawberry guava and melastoma shrubs, 12 to 15 ft. tall, are found here. Emerging above the 25 to 40 ft. tall 'ohi'a are scattered plants of gunpowder tree (Trema orientalis) and melochia (Melochia umbellata). The ground cover consists largely of strawberry guava and melastoma seedlings along with patches of hairy sword fern (Nephrolepis multiflora). Blechnum fern (Blechnum occidentale) and shampoo ginger (Zingiber zerumbet) may be locally common. Moss-covered rocks are also frequent. Lygodium japonicum, a lacy, slender, climbing fern, is locally abundant along the edges of this forest and along the trails cut through the forest, especially along the powerline easement. Lygodium has escaped from gardens around Hilo town and has established itself in surrounding woods and gulches (Char 1992).

The third and minor variant of this vegetation type includes the plants found in the disturbed areas within the 'ohi'a-uluhe forest. The plants in these areas consist of an assortment of

largely introduced grasses, herbs, shrubs, and saplings. These include torpedo grass (Panicum repens), molasses grass (Melinis minutiflora), broomsedge (Andropogon virginicus), partridge pea (Chamaecrista nictitans), sensitive plant or puahilahila (Mimosa pudica), pluchea (Pluchea symphytifolia), melastoma, a number of Desmodium and Crotalaria species, and saplings of melochia and gunpowder tree. Two native species occur in fairly large numbers in these more open, sunny areas. Neneleau (Rhus sandwicensis), a small tree, 6 to 24 ft. tall, belonging to the mango family, is common along the powerline easement. Scleria testacea, a sedge with sharp-edged leaf margins, is locally abundant along "Road B", near the JAC facility. Also found in this area are a few plants of 'akiohala (Hibiscus furcellatus), a native, pink-flowered hibiscus.

#### Introduced Mixed Forest

This vegetation type occurs on the portion of the property with Panaewa soil ("PeC"), a relatively deep, dark brown silty clay loam. The forest consists primarily of large gunpowder and melochia trees, 30 to 50 ft. tall. Other tree species found in this forest type include Chinese banyan (Ficus microcarpa), guarumo (Cecropia obtusifolia), bingabing (Macaranga mappia), African tulip (Spathodea campanulata), satin leaf (Chrysophyllum oliviforme), and avocado (Persea americana). Large groves of Alexandra or king palm (Archontophoenix alexandrae) are common along the western portion of this forest, near the Waiola River and across from the University of Hawai'i Hilo campus. A stand of very old mango trees (Mangifera indica) is also found in this forest type.

The common yellow guava (Psidium guajava) forms somewhat dense shrub layers in some places of the forest. Seabean (Dioclea wilsonii), a large woody liana which produces clusters of dark

purple flowers, is occasionally observed climbing over the trees and shrubs.

Ground cover is variable. Where the tree canopy cover is dense, only the more shade-tolerant plants such as wood fern (Christella parasitica) and Oplismenus compositus can be found, however, much of the ground is barren, wet soil. Where the trees thin out and there is more light available, clumps of palmgrass (Setaria palmifolia), up to 3 ft. tall, and low, rambling prickly shrubs of thimbleberry (Rubus rosifolius) are abundant.

Along the eastern edge of the forest where it abuts the Waiola River, it is open and the ground is covered by a thick blanket of California grass (Brachiaria mutica) and wedelia (Wedelia trilobata). Scattered through the California grass and wedelia are plants of honohono (Commelina diffusa), primrose willow (Ludwigia octovalvis), and a few guava shrubs. Also found along or near the river are clumps of banana (Musa X paradisiaca), ti (Cordyline fruticosa), elephant grass (Pennisetum purpureum), and yellow ginger (Hedychium flavescens).

#### DISCUSSION AND RECOMMENDATIONS

In summary, the native-dominated 'ohi'a-uluhe forest occurs on the younger substrates -- the 1881 Lava Flow and Keaukaha extremely rocky muck. The geologically older Panaewa soil type supports a forest composed primarily of introduced species. The 'ohi'a-uluhe forest represents a fairly early stage in plant succession on wet lava flows, and, although, both of these native species make up the bulk of the vegetation, this type of forest does not have a rich array of other native species.

Of a total of 122 species inventoried on the site, 100 (82%) are introduced or alien species, 6 (5%) are originally of Polynesian

introduction, and 16 (13%) are native. Of the natives, 12 are indigenous, that is, they are native to the Hawaiian Islands and also elsewhere, and 4 are endemic, that is, they are native only to the islands. The majority of the introduced species are weedy plants which prefer open, disturbed sites. The native species can be found in similar environmental habitats throughout the islands. None of the plants inventoried on the State-owned parcel are officially listed threatened and endangered species; nor are any proposed or candidate for such status (U.S. Fish and Wildlife Service 1989, 1990).

Given the findings above, the proposed project is not expected to have a significant negative impact on the botanical resources. Whenever possible native plants should be used for landscaping. The following recommendations are offered. On portions of the property covered by the 'ohi'a-uluhe forest, there are some areas with slopes greater than 10% and it would be difficult to build on these areas without substantial grading. It is suggested that these areas be left intact, and incorporated into the landscape design wherever feasible. These strips of 'ohi'a-uluhe forest would provide a buffer between the different facilities planned for the site; they would function as a noise screen and also protect the visual quality of the site. Costs for grading and then revegetating these areas could be eliminated.

As for landscaping material, it is recommended that some of the more easily cultivated native species found in the general region (Hamakua-Hilo-Puna) be used. These include 'ohi'a, tree ferns (Cibotium), 'ahanui (Machaerina), 'ohe (Tetraplasandra), loulu palm (Pritchardia), etc. Botanists and horticulturists on the UH Hilo and Hilo Community College facility, who are more familiar with the local flora, can also be approached to provide a list of native species suitable for landscaping the project site.

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- Macdonald, G.A. and A.T. Abbott. 1970. Volcanoes in the sea, the geology of Hawaii. 5th printing. University of Hawaii Press, Honolulu.
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- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. 2 vols. University of Hawai'i Press and Bishop Museum Press, Honolulu. Bishop Museum Special Publication No. 83.

PLANT SPECIES LIST -- Proposed Infrastructure for Research and  
Technology Lots at UH - Hilo

A checklist of all those terrestrial, vascular plant species inventoried on the project site during the field studies is presented below. The species are arranged alphabetically within each of three groups: Ferns, Monocots, and Dicots. The taxonomy and nomenclature of the Ferns follow Lamoureux (1984); the flowering plants, Monocots and Dicots, are in accordance with Wagner et al. (1990), for the most part.

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:
  - E = endemic = native only to the Hawaiian Islands
  - I = indigenous = native to the Hawaiian Islands and also elsewhere throughout the Pacific
  - P = Polynesian = plants originally of Polynesian introduction prior to Western contact (Cook's discovery of the islands in 1778); not native
  - X = introduced or alien = all those plants brought to the islands by humans, intentionally or accidentally, after Western contact; not native.
4. Presence (+) or absence (-) of a particular species within each of two vegetation types recognized on the project site (see text for discussion):
  - o = 'Ohi'a-Uluhe Forest
  - i = Introduced Mixed Forest



Vegetation type

0 1

Status

Common name

Scientific name

FERNS

BLECHNACEAE (Blechnum Family)  
Blechnum occidentale L.

blechnum fern

X

+

DICKSONIACEAE (Tree Fern Family)  
Cibotium glaucum (J. Sm.) Hook. & Arnott

hapu'u

E

-

GLEICHENIACEAE (Vine Fern Family)  
Dicranopteris linearis (Burm.) Underw.

uluhe

I

+

HEMIONITIDACEAE (Gold Fern Family)  
Pityrogramma calomelanos (L.) Link

silver fern

X

+

LINDSAEACEAE (Lace Fern Family)  
Sphenomeris chinensis (L.) Maxon

paia'a

I

-

LYGODIACEAE (Climbing Fern Family)  
Lygodium japonicum (Thunb.) Sw.

lygodium

X

+

NEPHROLEPIDACEAE (Sword Fern Family)  
Nephrolepis multiflora (Roxb.) Jarrett  
ex Morton

hairy sword fern

X

+

POLYPODIACEAE (Common Fern Family)  
Phlebodium aureum (L.) J. Sm.

laua'e-haole

X

+

Phymatosorus scolopendria (Burm.) Pic.-Ser.

laua'e, lauwa'e

X

+

Pleopeltis thunbergiana Kaulf.

pakahakaha, 'ekaha-'akolea

I

+

THELYPTERIDACEAE (Woodfern Family)  
Christella parasitica (L.) Levl.

woodfern, oakfern

X

+

Vegetation type

Status      0      1

Common name

Scientific name

FLOWERING PLANTS

MONOCOTS

AGAVACEAE (Sisal Family)  
Cordylone fruticosa (L.) A. Chev.

ti, ki

P

+ +

ARACEAE (Aroid Family)  
Dieffenbachia picta Schott

dieffenbachia

X

+ -

ARECACEAE (Palm Family)  
Archontophoenix alexandrae (F. v. Muell.)  
H.A. Wendl. & Drude

king palm, Alexandra  
palm

X

+ +

COMMELINACEAE (Dayflower Family)  
Commelina diffusa N.L. Burm.

honohono

X

- +

CYPERACEAE (Sedge Family)

Cyperus halpan L.  
Fimbristylis dichotoma (L.) Vahl.  
Kyllinga brevifolia Rottb.  
Machaerina mariscoides ssp. meyenii  
(Kunth) T. Koyama  
Pycneus polystachyos (Rottb.) P. Beauv.  
Scleria testacea Nees

green kyllinga, killi'o'opu

'ahaniu, 'uki

X

I

X

E

I

I

+ + +

+ + +

+ + +

- - -

- - -

- - -

DIOSCOREACEAE (Yam Family)

Dioscorea bulbifera L.  
Dioscorea pentaphylla L.

bitteryam, pi'oi  
pi'ia

P

P

+ +

+ +

MUSACEAE (Banana Family)  
Musa X paradisiaca L.

banana, maia

P

- +

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>	<u>Vegetation type</u>	
			<u>0</u>	<u>1</u>
ORCHIDACEAE (Orchid Family)				
Arundina graminifolia (D. Don) Hochr.	bamboo orchid	X	+	-
Spathoglottis plicata Blume	Philippine ground orchid	X	+	+
PANDANACEAE (Hala Family)				
Pandanus tectorius S. Parkinson ex Z.	pandanus, hala	I?	+	-
POACEAE (Grass Family)				
Andropogon virginicus L.	broomsedge	X	+	-
Brachiaria mutica (Forsk.) Stapf	California grass	X	+	+
Coix lachryma-jobi L.	Job's tears	X	+	+
Digitaria sp.	crabgrass	X	+	-
Eragrostis sp.	Hamakua eragrostis	X	+	-
Melinis minutiflora P. Beauv.	molasses grass	X	+	-
Oplismenus compositus (L.) P. Beauv.	Guinea grass	X	-	+
Panicum maximum Jacq.	torpedo grass, Wainaku grass	X	+	-
Panicum repens L.	Hilo grass, mau'u Hilo	X	+	+
Paspalum conjugatum Bergius	ricegrass, mau'u laiki	I?	+	-
Paspalum scrobiculatum L.	napier grass, elephant grass	X	-	+
Pennisetum purpureum Schumach.	Natal redtop	X	+	-
Rhynchelytrum repens (Willd.) Hubb.	Glenwood grass	X	+	-
Sacciolepis indica (L.) Chase	yellow foxtail	X	+	-
Setaria gracilis Kunth	palmgrass	X	+	+
Setaria palmifolia (J. König) Stapf		X	+	+
ZINGIBERACEAE (Ginger Family)				
Hedychium flavescens N. Carey ex Roscoe	yellow ginger	X	-	+
Zingiber zerumbet (L.) Sm.	shampoo ginger, 'awapuhi kuahtwi	P	+	-
DICOTS				
ACANTHACEAE (Acanthus Family)				
Justicia betonica L.	white shrimp plant	X	+	-

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>	<u>Vegetation type</u>	
			<u>0</u>	<u>1</u>
ANACARDIACEAE (Mango Family)				
Mangifera indica L.	mango, manako	X	+	+
Rhus sandwicensis A. Gray	neneleau	E	+	-
Schinus terebinthifolius Raddi	Christmas berry	X	-	+
APIACEAE (Parsley Family)				
Centella asiatica (L.) Urb.	Asiatic pennywort, pohe kula	X	+	-
ARALIACEAE (Ginseng Family)				
Schefflera actinophylla (Endl.) Harms	octopus tree, umbrella tree	X	+	+
ASTERACEAE (Sunflower Family)				
Ageratina riparia (Regel) R. King & H. Robinson	pamakani	X	-	+
Ageratum houstonianum Mill.	maile hohono	X	+	-
Bidens alba var. radiata (Schultz-Bip.) Ballard ex Melchert	white-flowered bidens	X	-	+
Crassocephalum crepidioides (Benth.) S. Moore	crassocephalum	X	+	-
Eclipta alba (L.) Hassk.	false daisy	X	+	-
Emilia fosbergii Nicolson	pua lele	X	+	-
Erechtites valerianifolia (Wolf) DC.	fireweed	X	+	-
Pluchea symphytifolia (Mill.) Gillis	pluchea, sourbush	X	+	-
Sonchus oleraceus L.	sow thistle, pua-lele	X	+	-
Wedelia trilobata (L.) Hitchc.	wedelia	X	+	+
BALSAMINACEAE (Touch-me-not Family)				
Impatiens wallerana J.D. Hook.	impatiens	X	-	+
BEGONIACEAE (Begonia Family)				
Begonia foliosa var. miniata (Planch.) L.B. Sm. & B.G. Schubert	fuschia begonia	X	-	+
Begonia hirtella Link	white-flowered begonia	X	+	-
BIGNONIACEAE (Bignonia Family)				
Spathodea campanulata P. Beauv.	African tulip	X	-	+

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>	<u>Vegetation type</u>	
			<u>o</u>	<u>i</u>
BOMBACACEAE (Bombax Family) Indet. sp.		X	-	+
BUDDLEIACEAE (Butterfly Bush Family) Buddleia asiatica Lour.	Asiatic butterfly bush, huele- 'ilio	X	+	-
CAMPANULACEAE (Bellflower Family) Hippobroma longiflora (L.) G. Don	star-of-Bethlehem	X	+	-
CARYOPHYLLACEAE (Pink Family) Drymaria cordata (L.) Willd. ex Roem.	pipili	X	-	+
CECROPIACEAE (Cecropia Family) Cecropia obtusifolia Bertol.	guarumo	X	-	+
CLUSIACEAE (Mangosteen Family) Clusia rosea Jacq.	autograph tree, copey	X	+	+
CONVOLVULACEAE (Morning-glory Family) Ipomoea alba L. Ipomoea indica (J. Burm.) Merr. Ipomoea triloba L.	moonflower, koali pehuf koali 'awahia little bell, pink bindweed	X I X	+	- - -
EUPHORBIACEAE (Spurge Family) Macaranga mappia (L.) Müll. Arg. Phyllanthus debilis Klein ex Willd. Ricinus communis L.	bingabing niruri castor bean, koli, pa'ailla	X X X	- + +	+ - -
FABACEAE (Bean Family) Caesalpinia major (Medik.) Dandy & Exell Chamaecrista nictitans (L.) Moench Crotalaria cf. lanceolata E. Mey. Crotalaria pallida Aiton Crotalaria retusa L.	kakalaioa, hihikolo partridge pea, lauki smooth rattlepod, pikakant	X? X X X X	+	- - - - -

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>	<u>Vegetation type</u>	
			<u>o</u>	<u>i</u>
Desmodium cajanifolium (Kunth) DC.	tick clover	X	+	-
Desmodium incanum DC.	Spanish clover, ka'imi	X	+	-
Desmodium intortum (Mill.) Urb.	Florida beggarweed	X	-	+
Desmodium tortuosum (Sw.) DC.		X	+	-
Desmodium sp. 1		X	+	-
Desmodium sp. 2	sea bean, maunaloa	X	+	-
Dioclea wilsonii Standl.		X?	-	+
Mimosa pudica var. unijuga (Duchass. & Walp.) Griseb.	sensitive plant, sleeping grass, pua hila hila	X	+	-
LAMIACEAE (Mint Family)				
Hyptis pectinata (L.) Poit.	comb hyptis	X	+	-
Lauraceae (Laurel Family)				
Persea americana Mill.	avocado, alligator pear	X	-	+
LYTHRACEAE (Loosestrife Family)				
Cuphea carthagenensis (Jacq.) Macbr.	tarweed, Colombian cuphea	X	+	-
MALVACEAE (Mallow Family)				
Hibiscus furcellatus Desr.	'akiohala, 'akiahala, hau hele	I	+	-
Sida rhombifolia L.	Cuba jute	X	+	-
MELASTOMACEAE (Melastoma Family)				
Dissotis rotundifolia (Sm.) Triana	dissotis	X	+	-
Melastoma candidum D. Don	melastoma	X	+	+
MORACEAE (Mulberry Family)				
Ficus microcarpa L. f.	Chinese banyan	X	-	+
MYRTACEAE (Myrtle Family)				
Metrosideros polymorpha Gaud.	'ohi'a, 'ohi'a lehua	E	+	-
Psidium cattleianum Sabine	strawberry guava	X	+	+
Psidium guajava L.	guava, kuawa	X	+	+

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>	<u>Vegetation type</u>	
			<u>o</u>	<u>i</u>
ONAGRACEAE (Evening Primrose Family) Ludwigia octovalvis (Jacq.) Raven	primrose willow, kamole	P?	-	+
OXALIDACEAE (Wood Sorrel Family) Oxalis corymbosa DC.	pink wood sorrel, ihi pehu	X	-	+
PASSIFLORACEAE (Passionflower Family) Passiflora edulis Sims Passiflora foetida L.	passionfruit, liliko'i scarlet-fruited passionflower, pohapoha	X X	- +	+ -
PIPERACEAE (Pepper Family) Peperomia leptostachya Hook. & Arnott	'ala 'ala wai nui	I	-	+
POLYGALACEAE (Milkwort Family) Polygala paniculata L.	bubble-gum plant	X	+	-
POLYGONACEAE (Buckwheat Family) Polygonum sp.		X	-	+
ROSACEAE (Rose Family) Rubus rosifolius Sm.	thimbleberry	X	+	+
RUBIACEAE (Coffee Family) Hedyotis corymbosa (L.) Lam. Paederia scandens (Lour.) Merr. Spermacoce assurgens Ruiz & Pav. Spermacoce mauritiana Gideon	maile-pilau buttonweed	X X X X	+ + + +	- + - -
SAPINDACEAE (Soapberry Family) Filicium decipiens (Wight & Arnott) Thwaites ex J.D. Hook.	fern tree	X	-	+
SAPOTACEAE (Sapodilla Family) Chrysophyllum oliviforme L.	satin leaf	X	-	+

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

<u>Scientific name</u>	<u>Common name</u>	<u>Status</u>	<u>Vegetation type</u>	
			<u>o</u>	<u>i</u>
SCROPHULARIACEAE (Figwort Family) Castilleja arvensis Cham. & Schlechtend.	Indian paintbrush	X	+	-
STERCULIACEAE (Cacao Family) Melochia umbellata (Houtt.) Stapf	melocheia	X	+	+
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloo	I?	+	-
ULMACEAE (Elm Family) Trema orientalis (L.) Blume	gunpowder tree, charcoal tree	X	+	+
URTICACEAE (Nettle Family) Pilea microphylla (L.) Liemb.	artillary plant, rockweed	X	-	+
VERBENACEAE (Verbena Family) Lantana camara L.	Lantana, lakana	X	+	-
Stachytarpheta dichotoma (Ruiz & Pav.) Vahl	owi, oi	X	+	-



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May 1996

**BOTANICAL RESOURCES ASSESSMENT STUDY  
STREAM CHANNEL AREA  
UNIVERSITY OF HAWAI'I - HILO  
HILO, ISLAND OF HAWAI'I**

## **INTRODUCTION**

The proposed project along Waiakea Stream is for improvements to the stream channel and construction of a bridge to connect University Park to the main UH Hilo campus. The study area is located mauka (west of) the student dorms and the College of Agriculture facilities.

Field studies to assess the botanical resources found on the project site were conducted on 16 April 1996 by a team of two botanists. The primary objectives of the walk-through field survey were to describe the vegetation, search for threatened and endangered species, and identify areas of potential environmental problems or concerns, particularly the presence of wetlands, and propose appropriate mitigation measures.

A discussion of the vegetation found on the project site follows. The plant names used are in accordance with Wagner *et al.* (1990) for the flowering plants and Lamoureux (1988) for the ferns.

## DESCRIPTION OF THE VEGETATION

The vegetation on the University Park parcel was surveyed by Char in November 1992 for the proposed infrastructure for the research and technology lots. Introduced mixed forest composed primarily of large gunpowder (Trema orientalis) and melochia (Melochia umbellata) trees as well as several other tree species in smaller numbers occurs on the University Park land adjacent to the stream channel study area. Locally abundant near the study area is a grove of Alexandra or king palm (Archontophoenix alexandrae). On the UH Hilo campus side, the vegetation consists of mats of California grass (Brachiaria mutica) with sourbush or pluchea (Pluchea symphytifolia) shrubs and small stands of gunpowder and melochia trees. This area appears to be infrequently maintained.

Wedelia (Wedelia trilobata), a commonly used ground cover species, is abundant along both banks of the stream. California grass occurs as small scattered patches. Other species occasionally encountered here include small clumps of palmgrass (Setaria palmifolia), downy woodfern (Christella parasitica), and yellow ginger (Hedychium flavescens); a few small guava shrubs (Psidium guajava); and smaller herbaceous species such as oriental hawk-beard (Youngia japonica), bubble-gum plant (Polygala paniculata), and maile hohono (Ageratum houstonianum).

The stream has been eroded down to the bedrock of solid, dense pahoehoe lava. Scattered here and there in depressions are a few shallow pools of water. Some of the herbaceous plants and seedlings of the woody components mentioned previously occur in the stream bed where there are small pockets of soil and gravel. Much of the stream bank is also solid bedrock.

No wetlands occur within the project site. All three criteria for determining wetlands must be present; these are the presence of hydric soils, wetland indicator species (hydric vegetation), and hydrology (Environmental Laboratory 1987). On the project site, there are no areas with hydric soils as the stream bed and most of the stream bank is solid bedrock. Wetland indicator species (Reed 1988) do not cover 50% or more of the site and the vegetation is composed largely of upland species.

#### DISCUSSION AND RECOMMENDATIONS

The vegetation on the site proposed for the stream channel improvements and the bridge are dominated by alien or introduced plant species; these are all those plants which were brought to the Hawaiian Islands by humans after Western contact, that is, Cook's discovery of the islands in 1778. None of the plants encountered during the survey is a threatened and endangered species (U.S. Fish and Wildlife Service 1994a, 1994b); nor is any plant considered rare or vulnerable (Wagner *et al.* 1990). No wetlands occur within the project site. Similar findings were recorded for the adjacent University Park parcel (Char 1992).

Given the findings above and the limited nature of the project, no significant negative impacts to the botanical resources are expected. No recommendations are proposed at this time.

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**BOTANICAL RESOURCES ASSESSMENT STUDY  
UH HILO UNIVERSITY PARK  
INFRASTRUCTURE IMPROVEMENTS, PHASE IIA  
RESERVOIR AND WATER LINE ALIGNMENT  
HILO, ISLAND OF HAWAI'I**

## **INTRODUCTION**

The proposed offsite water improvements will consist of a 0.5 MG reservoir and an influent line which will connect to an existing water line. The project site is located immediately east (makai) of the Sunrise Estates Subdivision. The proposed 200 ft. long by 200 ft. wide reservoir site is located within a much larger parcel which is 500 ft. long by 300 ft. wide. The proposed connecting water line alignment or corridor is 40 ft. wide by roughly 1,200 ft. long.

Field studies to assess the botanical resources found on the larger reservoir parcel and the water line corridor were made on 16 April 1996 by a team of two botanists. The primary objectives of the field survey were to describe the vegetation on the project site, search for threatened and endangered species as well as rare and vulnerable plants, and identify areas of potential environmental problems or concerns and propose appropriate mitigation measures.

A walk-through survey method was used. Notes were made on plant

associations and distribution, substrate types, topography, exposure, drainage, etc. The project site was accessed from the makai end of Pulo Street. The water line corridor follows along an old grub line now overgrown by various grasses and weedy herbs and shrubs. Portions of the reservoir parcel were staked and flagged prior to our field studies. The parcel is covered by dense vegetation consisting of an 'ohi'a/uluhe community with scattered patches of strawberry guava and melastoma shrubs.

#### DESCRIPTION OF THE VEGETATION

A description of the vegetation found on the reservoir parcel and the water line corridor is presented below. The plant names used in the discussion follow Wagner *et al.* (1990) for the flowering plants and Lamoureux (1988) for the ferns.

Reservoir Parcel: A portion of the vegetation on the parcel was surveyed by Gerrish (1992) for the future Puainako Street Extension project. Gerrish noted that the vegetation along this portion of the roadway corridor consisted of an 'ohi'a (Metrosideros polymorpha)/uluhe fern (Dicranopteris linearis) forest, but with many areas dominated by strawberry guava or waiawi (Psidium cattleianum) and other alien or introduced species.

On Hawai'i island, the 'ohi'a/uluhe forest is associated with young lava flows and shallow soils on the lower, windward slopes of the Puna and Hilo Districts (Cuddihy and Stone 1990). Typically, it is composed of dense, almost impenetrable, mats of uluhe fern with scattered, widely spaced 'ohi'a or 'ohi'a lehua trees up to 40 ft. tall. Because of the thick cover of uluhe fern, there are only a few other species associated with this vegetation type. On the reservoir site, the other native species which occur infrequently are 'ahaniu (Machaerina mariscoides), hapu'u (Cibotium glaucum), Scleria testacea, huehue (Cocculus trilobus), neneleau

(Rhus sandwicensis), and 'ama'u (Sadleria cyatheoides).

Strawberry guava and melastoma (Melastoma candidum) shrubs form 6 to 12 ft. tall thickets throughout the 'ohi'a/uluhe forest on the project site. Melastoma cover is denser along the lower half of the reservoir parcel. Both strawberry guava and melastoma are alien or introduced plants; these are plants which were brought to the islands by humans after Western contact, that is, Cook's discovery of the Hawaiian Islands in 1778. Since their introduction, both species have spread rapidly and invaded lowland mesic to wet habitats (Cuddihy and Stone 1990).

Ground cover under the melastoma and strawberry guava thickets is sparse, with much leaf litter and barren lava. A few blechnum fern plants (Blechnum occidentale) form small clumps here and there along with seedlings of the two alien shrub species. Under the dense mats of uluhe, ground cover is almost always absent; leaf and stem litter and barren lava predominate.

Water Line Corridor: The water line corridor follows along an old grub line for the most part. The vegetation on this disturbed area consists of a varied assemblage of mostly weedy, alien grasses, herbs, and shrubs. Broomsedge grass (Andropogon virginicus), and owi (Stachytarpheta dichotoma) are the most abundant components of the weedy vegetation in most places. Other species occasionally encountered include Glenwood grass (Sacciolepis indica), bamboo orchid (Arundina graminifolia), Spanish clover (Desmodium incanum), Hilo grass (Paspalum conjugatum), sleeping grass or puahilahila (Mimosa pudica), yellow foxtail (Setaria gracilis), hairy sword-fern or 'okupukupu (Nephrolepis multiflora), Spermacoce mauritiana, etc. Hairy swordfern is locally abundant where the corridor approaches the end of Puloku Street. Along the northern half of the corridor, sourbush (Pluchea symphytifolia) and young, 4 to 6 ft. tall melastoma and strawberry guava shrubs cover roughly 50%

of the corridor.

Along the corridor's edge, the 'ohi'a/uluhe forest is more disturbed and open. It supports patches of broomsedge and hairy swordfern as well as a number of alien plants which include melochia (Melochia umbellata), guava (Psidium guajava), and gunpowder tree (Trema orientalis). The uluhe fern cover is patchy with large thickets of strawberry guava and melastoma in between. Some native plants such as Scleria, pala'a fern (Sphenomeris chinensis), and neneleau prefer these more open, sunny areas.

A list of all the native species observed on the reservoir parcel and the water line corridor during the field studies is presented in Table 1.

#### DISCUSSION AND RECOMMENDATIONS

The native-dominated 'ohi'a/uluhe forest occurs on the reservoir parcel and along the edges of the water line corridor as well as the adjacent undeveloped lands. In places, the forest supports dense thickets of strawberry guava and melastoma. The 'ohi'a/uluhe forest represents a fairly early stage in plant succession on wet lava flows and does not support a rich diversity of native plant species. This vegetation type or plant community is fairly common on the relatively young lava flows in the Hilo and Puna Districts.

A large number of weedy species as well as a few native plants are found on the water line corridor. The corridor follows along an old grub line just makai of the subdivision.

No listed, proposed, or candidate threatened and endangered plant species (U.S. Fish and Wildlife Service 1994a, 1994b) were found



during the survey. Nor did we find any plants considered rare or vulnerable (Wagner et al. 1990).

Given the findings above and the limited nature of the project, the proposed project is not expected to have a significant negative impact on the botanical resources. There are no botanical reasons to impose any restrictions, impediments, or conditions to the proposed project.

TABLE 1. List of native plants found on the reservoir parcel and water line alignment, Hilo, Hawai'i.

Scientific name	Common name	*Status
<b><u>FERNS</u></b>		
BLECHNACEAE (Blechnum Fern Family)		
Sadleria cyatheoides Kaulf.	'ama'u, 'ama'uma'u	E
DICKSONIACEAE (Tree Fern Family)		
Cibotium glaucum (J. Sm.) Hook. & Arnott	hapu'u, hapu'u pulu	E
GLEICHENIACEAE (Vine Fern Family)		
Dicranopteris linearis (Burm.) Underw.	uluhe, unuhe	I
LINDSAEACEAE (Lace Fern Family)		
Sphenomeris chinensis (L.) Maxon	pala'a, pala pala'a	I
<b><u>FLOWERING PLANTS</u></b>		
ANACARDIACEAE (Mango Family)		
Rhus sandwicensis A. Gray	neneleau	E
CONVOLVULACEAE (Morning-glory Family)		
Ipomoea indica (J. Burm.) Merr.	koali 'awa	I
CYPERACEAE (Sedge Family)		
Machaerina mariscoides ssp. meyenii (Kunth.) T. Koyama	'ahaniu, 'uki	E I
Scleria testacea Nees		
MENISPERMACEAE (Moonseed Family)		
Cocculus trilobus (Thunb.) DC	huehue	I
MYRTACEAE (Myrtle Family)		
Metrosideros polymorpha Gaud.	'ohi'a lehua, 'ohi'a	E

TABLE 1. List of native plants. (Continued)

Scientific name	Common name	*Status
POACEAE (Grass Family) Paspalum scrobiculatum L.	ricegrass, mau'u laiki	I?
STERCULIACEAE (Cacao Family) Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?

\*Status

- E = endemic = native only to the Hawaiian Islands.
- I = indigenous = native to the Hawaiian Islands and also elsewhere throughout the Pacific and/or tropics.
- I? = questionably indigenous = data not clear if dispersal by natural or human-related mechanisms, but weight of evidence suggests probably indigenous.

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ARCHAEOLOGICAL SURVEY

**Appendix B**

**Archaeological Survey and Testing  
of Lands Proposed for Research and  
Technology Lots at the University of Hawaii at Hilo  
(TMK 2-4-01:7 and 41)**

by

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for

**Engineering Concepts**

by

Cultural Surveys Hawaii  
April 1993  
Revised November 1993

## ABSTRACT

During the weeks beginning December 14, 1992 and January 5, 1993 Cultural Surveys Hawaii conducted an archaeological inventory survey of approximately 163 acres of forested land in Waiākea *ahupua'a*, South Hilo district on the island of Hawai'i. The parcel under study is owned by the University of Hawaii at Hilo. Portions of this parcel are slated for the development of three research and technology lots. Construction of water, sewer, drainage, and electrical systems to service the three lots are proposed. The purpose of the study was to locate, and describe any and all archaeological resources within the survey area.

Two recent structures - the School of Agriculture Building at the southwest corner of the study area, and the Joint Astronomy Building in the central, *mauka* portion - are extant within the study area as well as portions of the access road system. Large swaths have also been bulldozed across the study area in a northwest-southeast orientation for an old water main, and in a generally east-west direction for an electric power line.

Archeological sites were located in the southern portion of the study area. Four sites were described and mapped to scale. Two of the sites - 18668, and 18669 - and a mound-feature within a third site - 18667 - were tested by hand excavations to document stratigraphy in the sites and to search for cultural remains to help in dating the sites.

The larger of the sites are two (2) expansive historic, agricultural fields (sites - 18667 and -18670). Field-rock clearing mounds are dispersed throughout both fields. The two other sites identified - 18668 and 18669 - were tested by excavation and were found to have no subsurface cultural deposits.

Based on the type and age of the sites found, and the data collected and analyzed, no further archaeological research specific to the sites within the study area is recommended.

## Supplemental Inventory Survey

Cultural Surveys Hawaii was requested to conduct an inventory level archaeological survey of an approximately 11-acre parcel adjacent to the 163-acre study area reported on in this report. The parcel is at the *makai* (east) side of the proposed U.H. Hilo Research and Technology Park and includes a section of the Waiakea Flood Control Channel. The survey was done as proposed infrastructure-related construction, associated with the development of the Research and Technology Park, is planned to traverse through this adjoining area.

During the supplemental survey, four (4) plantation-era (ca. 1870s-1940s) rock clearance features (mounds) and a wall were observed and recorded. These features were associated with commercial sugar cane cultivation within the former Waiakea Cane Lots. The four mounds and wall are included under State Historic Site # 50-10-35-18670 which was designated during the original survey.

Subsurface testing was conducted at two mounds within Site -18670 to address functional, chronological, and sampling concerns. Testing confirmed plantation-era style of construction. A supplemental report for the newly surveyed area - which details the survey and testing results is included here as an attachment.

## ACKNOWLEDGEMENTS

Field work for this project was carried out by Cultural Surveys Hawaii crew members Bryce Myers, Tyler Campbell, John Winieski, Tim Barr, Paul Kim and the authors. Each of us learned something new about ourselves from the *uluhe*.

Site descriptions for the report were compiled by Tim Barr. Drafting of field maps was done by Paul Kim and Joy Collins. Dr. Vickie Creed contributed her indefatigable energies and her typing and computer skills to the production of this report.



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## INTRODUCTION

For a period of seven days during the weeks beginning December 14, 1992 and January 5, 1993 Cultural Surveys Hawaii conducted an archaeological inventory survey of approximately 163 acres of forested land in Waiākea *ahupua'a*, South Hilo district on the island of Hawai'i (Figure 1-3). The parcel under study is located north of Waiākea Stream, *mauka* of the University of Hawaii at Hilo campus - a portion of which will be developed into 3 research and technology lots. The bed of Waiākea Stream has been rerouted recently, by mechanized equipment, probably under the name of flood control. The old stream bed is the actual south boundary of the study area, with the new stream bed farther south.

Two structures - the School of Agriculture building at the southwest corner of the study area, and the Joint Astronomy building in the central, *mauka* portion - are extant within the study area as well as portions of the access road system (Figure 4). Two sections of the new access road alignments are completed and in use, while other areas have been bulldozed although they are currently overgrown with vegetation. Large swaths have also been bulldozed around the Joint Astronomy building, across the study area in a northwest-southeast orientation for an old water main, and in a generally east-west direction for an electric power line.

### Study Area Description

The study area comprises approximately 163 acres in the *ahupua'a* of Waiākea. The lands are located within the district of South Hilo on the windward coast of Hawai'i Island. The study area, located in Hilo Town on the campus of the University of Hawai'i at Hilo, is bound by Komohana Street to the west, Waiākea Stream flood control channel

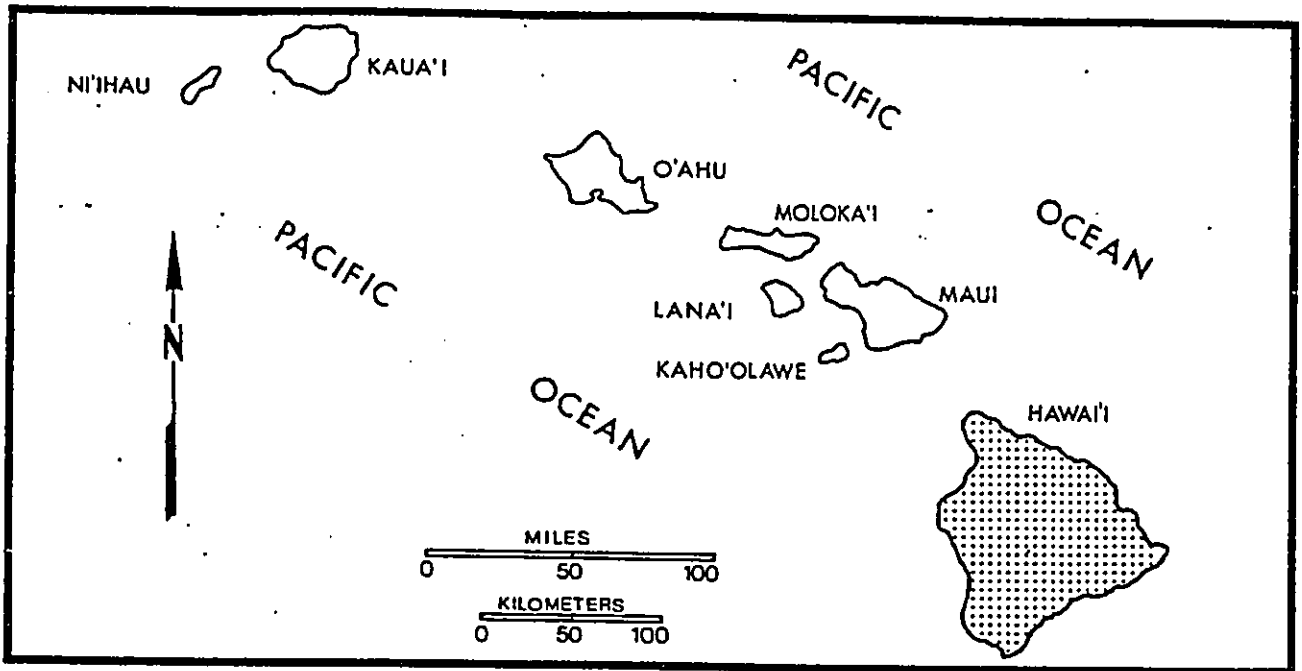


FIGURE 1  
State of Hawai'i

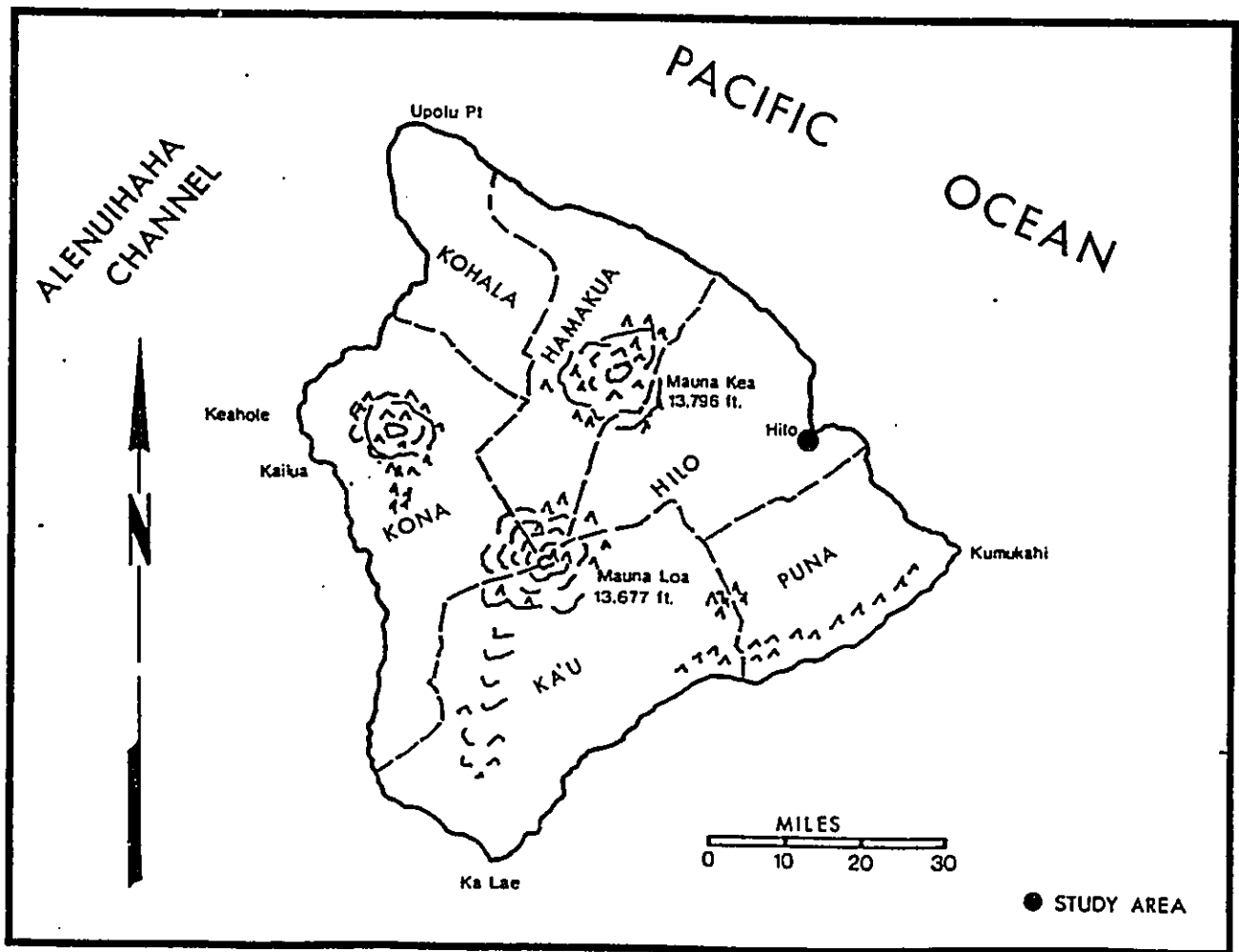


FIGURE 2  
General Location Map, Hawai'i Island

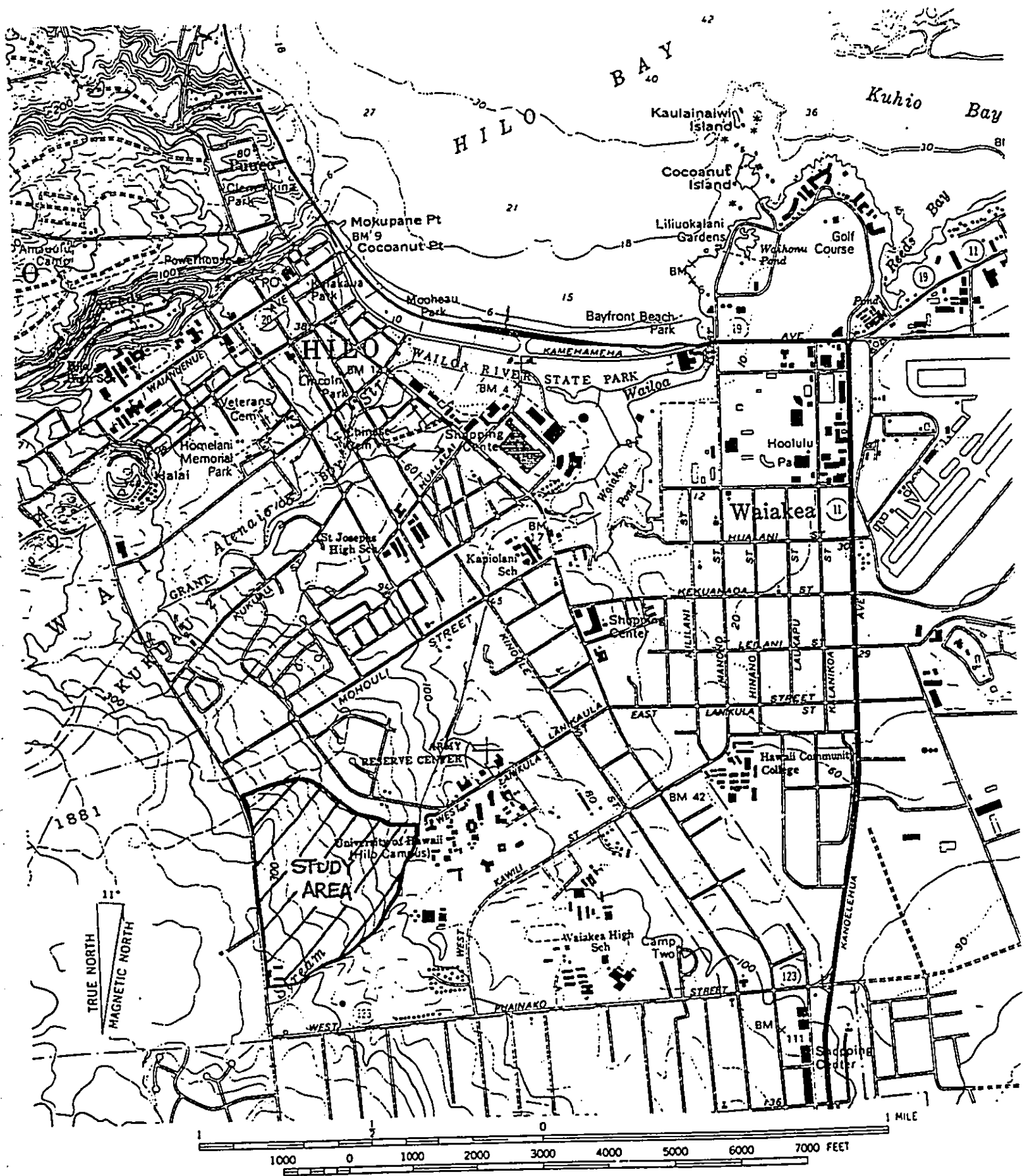


Figure 3 Portion of USGS Topographical Map, 7.5 Minute Series, Hilo Quadrangle, Showing Study Area

to the east, the old Waiākea Stream bed to the south, and a man-made drainage ditch to the north. Elevations within the study area range from roughly 140 ft. a.m.s.l. to 330 ft. a.m.s.l. on the lower east slope of Mauna Loa Volcano.

Several historic flows from Mauna Loa Volcano have affected the terrain along its eastern slope. An 1881 flow affected much of the Waiākea *Ahupua'a*, flowing into Hilo to within a mile of Hilo Bay. A part of the east end of this 1881 flow is present along the north side of the study area.

Rainfall in Waiākea *Ahupua'a* below the 5,000 ft. elevation averages 150 to 200 inches per year (Kelly et al. 1981); *makai* lands above the 5,000 ft. elevation receive an average of 30 inches of rain per year (McEldowney 1979). Waiākea Stream represents the only fresh water source within the study area.

The terrain is comprised predominately of lava flows thickly covered by vegetation. The *Soil Survey of the Island of Hawaii* (Sato et al., 1973) classifies the study area lands in three basic types as follows: 1) Pana'ewa very rocky, silty clay loam, 2) Keaukaha extremely rocky muck, and 3) pahoehoe lava flow. Although lava flows predominate in the study area, vegetation is dense due to the vast amounts of rain on the windward side of Hawaii Island.

The Pana'ewa very rocky, silty clay loam occurs along the southeast side of the study area. The vegetation in this area is characterized predominately by large guava trees (*Psidium cattleianum*) with little or no understory.

The Keaukaha extremely rocky muck which covers the largest portion of the study area, occurs in the central and north sections of the study area. The vegetation is characterized by guava thicket (*Psidium cattleianum*).

The pahoehoe lava flow occurs within the western half of the study area. The

vegetation is characterized by *uluhe* fern.

Development within the study area includes the aforementioned buildings; (Agriculture and Astronomy) associated parking lots, paved roads, and bulldozed swaths. In addition, a path for a water line has been cleared by bulldozing. These recent alterations to the landscape are a marked difference to the "jungle" of the rest of the study area. The speed of re-vegetation is quite evident where the bulldozed areas are in some cases barely discernible from the surrounding "jungle."



## CULTURAL HISTORY

The *ahupua'a* of Waiākea, South Hilo, is large, encompassing some 95,000 acres. It extends from the coast to approximately the 6,000 feet elevation on the windward slope of Mauna Loa (Figure 4). In 1979 Holly McEldowney prepared an "Archaeological and Historical Literature Search and Research Design," as part of a "Lava Flow Control Study" (McEldowney 1979). In her report McEldowney describes five zones of land use and associated resources. The five zones, which are applicable to Waiākea, include: I. Coastal settlement; II. Upland Agricultural; III. Lower Forest; IV. Rain forest; and V. Sub-Alpine or Montaine (*Ibid.*). The zones are described below from *mauka* (Zone V) to *makai* (Zone I) or in order of ascending importance in terms of settlement patterns.

Zone V (Sub-alpine), which is defined as being above the 5,500 ft. elevation, was probably of only marginal importance in terms of land utilization during prehistoric (pre-A.D. 1776) times. As McEldowney indicates "Use of major trails, although important to settlement and land use in all zones, probably dominated the utilization of this zone" (*Op. cit.*:30). Resources probably procured from this zone include birds like *nene* (geese) and *'ua'u* (petrel) for food, timber products, and possibly lithic materials. Though Waiākea extends into this sub-alpine zone it is not one of the major *ahupua'a* associated with this zone or the saddle region like Humu'ula which "cuts off" Waiākea at roughly the 6,000 foot elevation.

Zone IV (Rain Forest) is defined as ranging from 2,500 to 5,500 feet in elevation. Resources of bird feathers, medicinal plants, and possibly some timber products would have been procured from this zone with bird feathers probably of greatest importance. Habitation within this zone was probably exclusively temporary though possibly lava

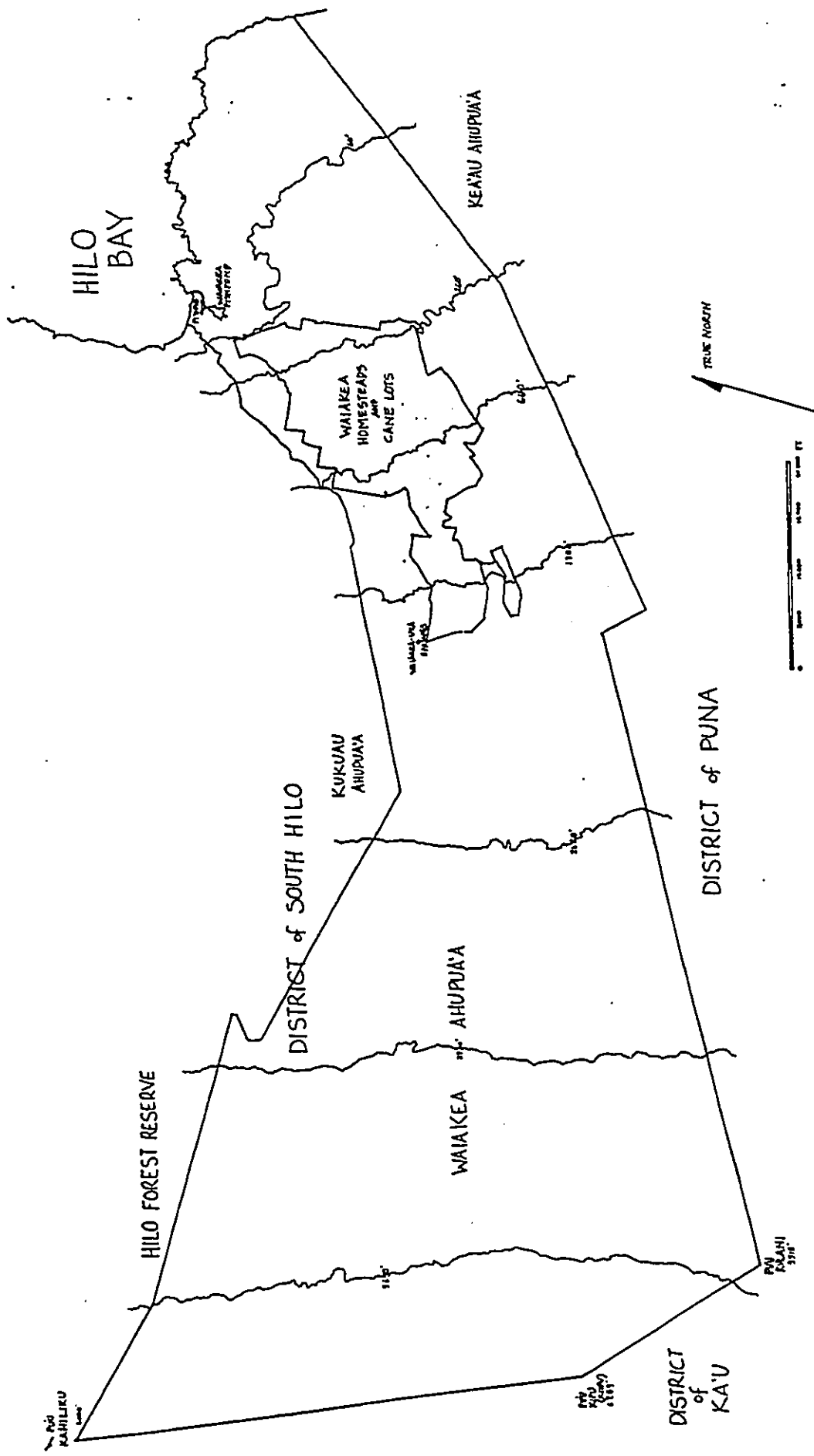


Figure 4 Ahupua'a of Waiakea (after USGS Topographic Map)

tubes or other site areas were utilized recurrently. In general, as McEldowney states because of "the less diversified use of this zone, and the implications of overnight visits rather than extended stays, make the overall potential for sites in this zone even lower" (i.e., compared to Zone III) (*Ibid.*).

Zone III (Lower Forest) is defined as ranging from 1,500 to 2,500 feet in elevation. McEldowney suggests that it is within this zone that the upper limits of the pre-historic farming took place. However, the main usage was probably still resource procurement of naturally occurring forest products. The farming or "supplemental food sources" would have included, "banana, wet and dry-land taro, ti, and yams (*Dioscorea* sp.) which were planted along streams and trails and in small patches of cleared forest" (*Op. cit.*:26). The forest products would have included a variety of timber, including Koa for canoes, bird feathers, dye and medicinal plants, mamaki which was used for a variety of bark cloth or kapa, *ie'ie* for basketry, *olonā* for cordage and a source of famine type foods, such as *hapu'u*. Habitation was still dominantly temporary though recurrent use is indicated by forest cultivation and the probably tending of specific forest products such as *olonā* (*Ibid.*).

Zone II (Upland Agricultural) is defined as ranging from 50 to 1,500 feet in elevation. The zone was described by "early visitors to Hilo Bay" as "an open parkland gently sloping to the base of the woods." ... "an expanse broken by widely spaced cottages" or huts, neatly tended gardens, and small clusters of trees" (*Op. cit.*: 19).

The present study area is situated within this upland agricultural zone. Though described as a vast "expanse" it would appear that only the more agriculturally productive areas were intensively farmed. In the 1820s it was "estimated that 1/20 of the expanse (i.e., zone of cultivation) in N. and S. Hilo was planted in crops" (Goodrich 1826:4 IN McEldowney 1979:21). The reasons for what appeared to the early visitors as a "lack of

more extensive planting " (*Ibid.*) include, the need for fallow periods especially in soils where nutrients are rapidly leached out, but more important to intensive agricultural use in the Hilo area is soil type or lack thereof. Intensive agriculture in Zone II was focused on areas with a soil mantle leaving younger exposed lava areas for plants not needing continuous care (e.g., grasses, ferns).

Habitation within the upland agricultural zone (i.e., Zone II) apparently including some permanent occupation sites but was still dominantly temporary. The descriptions of habitations refer to "scattered huts" with adjacent "garden plots" or "cottages" with "neatly tended gardens " (*Op. cit.*: 18-19) but no descriptions of village complexes like those along the coast.

Zone 1 (Coastal Settlement) is defined as " from sea level to roughly 20 to 50 ft. elevation or 1/2 mile inland" (*Op. cit.*: 15). This zone contained the majority of the population in village settings. The Hilo Bay area, of which Waiākea ahupua'a encompasses the southern half, was described "as a nearly continuous complex of native huts and garden plots interspersed with shady groves of trees, predominately breadfruit (*Artocarpus altilis*) and coconut (*Cocos nucifera*)." (*Op. cit.*:16). Additional sites mentioned included, "canoe sheds, several heiau, and large complexes catering to chiefs and their retainers" (*Ibid.*). Thus the coastal zone included virtually all of the permanent habitation sites and was the focal point of resource utilization procured elsewhere within the ahupua'a.

Based on the above zonal characterization of Waiākea the tradition or pre-contact (i.e., pre-A.D. 1776) settlement pattern included, a heavily populated coastal zone, an upland agricultural zone with forest zones beyond. The coastal zone included the village clusterings of the permanent habitations with direct access to rich and varied marine

resources including fishponds, and probably the majority of agricultural production as well.

The upland agricultural zone was probably expanded into as the prime lands within the coastal zone were intensively utilized. Over time the upland agricultural zone was converted from forest to an "open parkland" where plantings occurred on soil mantled lava flows. Habitation for most part was probably temporary with a few scattered permanent occupation complexes.

Beyond the upland agricultural zone was the forest which ranged from rain forest to sub-alpine forest. In Waiākea these forest zones were quite large which allowed for extensive gathering of forest products. The products in part included, timber, especially Koa for canoes, birds, for consumption (nene, 'ua'u) and feathers, medicinal and dye plants, and famine type foods.

#### Late Prehistoric Early Historic ca. 1790-1840

The rich and varied resources that Waiākea offered made it one of the most important locales on Hawaii Island. Traditional accounts concerning Waiākea include references to it being the seat of chiefly residences as early as ca. A.D. 1550 (Kelly, Nakamura, Barrère 1981). Chiefly associations with Waiākea continued through traditional times and into the historic era. Kamehameha retained Waiākea after he had conquered all of the islands (ca. 1800), and upon " his death his personally held Hilo lands, including Pi'i-honua, Punahoa, and Waiākea, descended to Liholiho, his son and heir to the kingdom,"..additionally " Kamehameha had given the ili kupono of Pi'opi'o to his favorite wife Ka'ahumanu" (*Op. cit.:* 11). The 'ili of Pi'opi'o is in Waiākea and is situated between Hilo Bay and Wailoa River and its associated fishponds.

Land use during the early historic period was still essentially subsistence based though aspects of major changes were occurring. The sandalwood trade, establishment of the American Board of Commissioners for Foreign Missions (ABCFM) station in Hilo, and the arrival of whalers began the shift away from subsistence to a market based economy. Settlement was still focussed on the coastal zone as was most of the agricultural production of both indigenous food crops and newly introduced plants.

During this early historic period the Forest and Sub-Alpine Zones land use was changing also. Besides the more traditional procurement of timber products and even bird feathers for taxes (McEldowney 1979:35). Cattle, goats, and sheep were being hunted in the upper zones. These animals were introduced in the 1790s and after an imposed 10 year prohibition on their killing had spread over large portions of the interior of Hawaii Island, especially the Waimea area. However, "by the 1830s substantial amounts of hides, jerked meat, and tallow were exported from Hilo" (*Op. cit.*:36).

#### Mid 1800s

Traditional land tenure changed during this time span to the privatization of land ownership. Generally referred to as the "Great Mahele" privatization actually included a number of government acts from the late 1840s to the mid 1850s. The Kamehameha dynasty's control over the valuable Waiākea *ahupua'a* was evidenced in that virtually the entire *ahupua'a* became Crown Lands with the *'ili* of Pi'opi'o awarded to Victoria Kamamalu (LCA 7713:16), a granddaughter of Kamehameha I and heir to Ka'ahumanu as well.

Twenty-six (26) Land Commission Awards (LCAs) were granted within Waiākea (Figure 5). None of these LCAs are within the present study area. The LCAs were all



within the coastal zone, except for two (2663 and 2402) which were in the lower portion (i.e., ca. 100 ft. a.m.s.l.) of the upland agricultural zone. The LCAs or *kuleana*(s) were for the most part focussed around the edges of the large fishponds of Waiākea. Land use information of the *kuleana* generally refer to cultivated fields with house lots indicating habitation and agricultural production within the same zone, unlike leeward Hawaii Island where in many cases *kuleana* included coastal house lots with the need of corresponding upland agricultural lots, because of elevation dependent rainfall.

Interior land use during this period was progressing toward more organized ranching, especially cattle ranching. Timber for firewood and housing was also still being exploited, as Hilo was being transformed into an entirely wooden-framed "New Bedford type Whaling Town" (*Op. cit.*:37).

Though the coastal zone still contained the vast majority of the population houses and stores were concentrated in the northern half of the bay, away from Waiākea, because the main pier for Hilo was at the mouth of Wailuku River (See Figure 5). This indicates a substantial change from the traditional settlement pattern of a "nearly continuous complex of native huts" along the bay's shoreline.

#### Late 1800s

During this period commercial sugar cane became the economic mainstay of the Hilo area with Waiākea Mill Company becoming one of the largest. Plantation operations generally developed ca. 1860s and for Waiākea this was on leased Crown lands. Waiākea Mill Company was in operation by the late 1870s and through its agents, Theo H. Davies and Alexander Young, had procured the lease of all of Waiākea by 1888 (Kelly, Nakamura, Barrère 1981:89). The mill was located at the head (*mauka* end) of Waiākea



Fishpond and sugar was transported by barge through the pond and down Wailoa River to Hilo Bay.

Immigrant labor (Chinese, Japanese, Portuguese) were living in "camps" set up by the plantation for its workers. Waiākea Mill Co. would eventually have some 10 camps situated along major rail lines of the plantation (Figure 6).

Land use was dominated by commercial cane activities within Zones I to III (Coast to Lower Rain Forest). Ranching became formalized though not specific to Waiākea. "Other examples of business, not directly related to sugar cultivation, were the continued use of the Waiākea fishponds, an active Chinese fish market, small pastures above Hilo supporting dairy cattle, and scattered vegetable gardens" (McEldowney 1979:39).

#### Early 1900s

Sugar and its associated industries continued to expand during this period. The Hawaii Consolidated Railway was built eventually extending "from Waiākea Mill and wharf through Puna, most of Ōla'a and along the N and S Hilo coast" (*Op. cit.*:41). Many of the immigrant laborers from the late 1800s moved off the plantation, being replaced by new Filipino laborers. Hilo continued to grow and become the second largest urban center in the new Territory of Hawaii.

Ranching in the Hilo areas, but not specifically in Waiākea, came under the control of two large enterprises; the Parker and Shipman Ranches. In Waiākea a large portion of Zone II (Upland Agricultural Zone) too rocky for sugar cane cultivation became available for lease as Waiākea pasture lands. The present study area is mostly former Waiākea pasture land. The specific use of the pasture land is not known but McEldowney indicates that "A substantial amount of grazing land adjacent to Hilo or to sugarcane



fields supported dairy cows for Hilo's several dairies" (*Ibid.*).

In 1918 the 30-year lease of the Waiākea Mill Co. expired and because Hawaii had become a Territory the "land fell under homesteading laws that required the government to put some of it up for lease to homesteaders who would be willing to grow sugar cane on it. Waiākea Mill was to grind the crop for them. A total of about 700 acres of land was divided into cane lots (between 10 and 76 acres each) and house lots ranging from 1 to 3 acres..." (Kelly, Nakamura, Barrère 1981:121). The present study area includes a portion of cane lot #16 (refer to Figure 6). The homestead and cane lots eventually reverted to the overall mechanized cultivation of the mill company as the homestead and cane lots "experiment was declared a failure" (*Op. cit.*:121).

By the 1920s the Waiākea Mill Co. had some 7,000 acres in cane production. Also, in the 1920s large tracts of remaining forest in Waiākea were "designated as forest reserve" (McEldowney 1979:42). The main reason appears to have been for maintaining the "forest as a 'watershed' to capture, retain, and support the continuous flow of water necessary to the sugar industry" (*Ibid.*). Clearly, sugar was the dominate economic factor during this period including the formation of settlements (i.e. camps).

#### Mid 1900s till present

Plantation life dominated the early portion of this time span but in 1948 Waiākea Mill Co. was liquidated (Condé and Best 1973:119). However, a major industry associated with cane by-products, canec, was begun in 1928. The canec plant was located adjacent to Waiākea Mill with bagasse, the cane by-product utilized, pumped through pipes from the mill to the plant. The canec plant shut down operations in 1966.

During this period major construction jobs started in the 1920s were completed.

These major construction jobs, in part, included Hilo Bay, wharfs and breakwater and bridges. Some of these projects were actually major reconstruction work from damage during the winter of 1923, which included storm surf in January and a tidal wave in February (Kelly, Nakamura and Barrère 1981:171). During the World War II period in Hilo, expansion and designation of Hilo airport as General Lyman Field and the construction of the Saddle Road were major projects undertaken as part of the military presence on the island, which was very substantial.

Prior to the closing of the Waiākea Mill Co. there were at least 10 "camps" or plantation villages. Only Camp 1 was within the coastal zone with Camps 2 to 10 within the upland agricultural zone with Camp 10 the highest at ca. 1300 ft. a.m.s.l. (Refer to Figure 6). The present study area included active mechanized cane cultivation probably right up until closing (1948), and leased pasture lands. The lease of the Waiākea pasture lands during this period was to a Mr. Kazuo Miyasaki (G.L. #2751 exp. 6/17/60). Specific use of the pasture is not known, but as mentioned previously, dairy cattle pasturage is a distinct possibility.

After statehood (1959) and with the closing of the mill and canec plant, tourism was looked at as the next economic mainstay. In Waiākea, C. Brewer & Co. built a hotel complex at the site of the old canec plant. Other hotels were built along the Hilo Bay frontage of Waiākea near Coconut Island or Mokuola. Large tracts of former Waiākea Homestead and Cane lots were converted to housing or sub-division tracts adjacent to the study area. U.H. Hilo campus was expanded as it continues to do presently. The study area itself ceased to be utilized for pasturage (ca 1960s?) and recently there has been construction of the School of Agriculture building and the Joint Astronomy building.

## Summary

In summary, the traditional settlement pattern included, almost exclusively, permanent coastal habitation with associated intensive agriculture. Immediately upslope of the coastal zone was an area cleared for extensions of agricultural production though not as intensively utilized as in the coastal zone. Beyond or *mauka* of the cleared upland agricultural zone was forest which ranged from dense rain forest to sub-alpine forest at the upper limit of Waiākea (ca. 6,000 feet). Habitation for the zones beyond the coastal zone was essentially temporary in nature, associated with exploitation of forest products. This pattern changed over time as the historically introduced religion(s), economy, and socio-political system replaced the traditional Hawaiian system. The major impetus for change was the development of commercial sugar cane within Waiākea. Settlement patterns during the period from the mid 1800s to the mid 1900s were almost exclusively set by the Waiākea Mill Co. Camps for immigrant laborers were constructed at specific locations based on the plantation organization. Most of these permanent housing locations were in areas previously associated with sparsely scattered temporary habitations in the upland agricultural zone of Waiākea. Because most of the study area was too rocky (i.e. exposed pahoehoe) for commercial cane, associated camps were not present. It appears that historically most of the study area was utilized as pasture land.

Hilo eventually became the second largest urban center in the State of Hawaii. Permanent housing is no longer dependent on a specific set of environmental conditions as it was during traditional Hawaiian times. The large acreage involved in subsistence agriculture and utilization of resources specific to certain elevations is no longer a necessity because of the market-based economy of today.

## PREVIOUS ARCHAEOLOGICAL RESEARCH

There have been a number of archaeological and historic studies that are pertinent to the *ahupua'a* of Waiākea within which the study area lies. Notable among these somewhat regional studies are, Alfred E. Hudson's 1930s East Hawaii Site Survey, Holly McEldowney's "Archaeological and Historical Literature Search and Research Design, Lava Flow Control History," and "Hilo Bay: A Chronological History" (Marion Kelly, Barry Nakamura and Dorothy B. Barrère 1981). Review of these documents, and others, indicated that no previously documented sites with state site numbers were located within the present study area. These regionally oriented studies, however, were the basis for describing the settlement pattern specific to Waiākea *ahupua'a*. The discussion of settlement patterns is contained within Cultural History section of this report.

Additionally, a "Summary of Prior Archaeological Work" compiled by Ms. Jadelyn J. Moniz (1992) for Waiākea list ten studies ranging from field inspections to inventory surveys. The studies include research from 1979 to 1992. The description of each of the ten previous studies includes a basic review of findings and relating "adequacy" for the individual reports in terms of inventory level survey," based on Title 13, Subtitle 6, Chapter 147: Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports" (Moniz 1992).

The following discussion of previous research will focus on work specifically related to the present study area (Figure 7).

There have been no previous inventory-level archaeological surveys specific to the current study area. However, "field inspections" and a reconnaissance-level survey for the proposed Puainako Street Extension (Hunt, 1992) indicate the presence of archaeological sites in an area adjacent to the present study area.

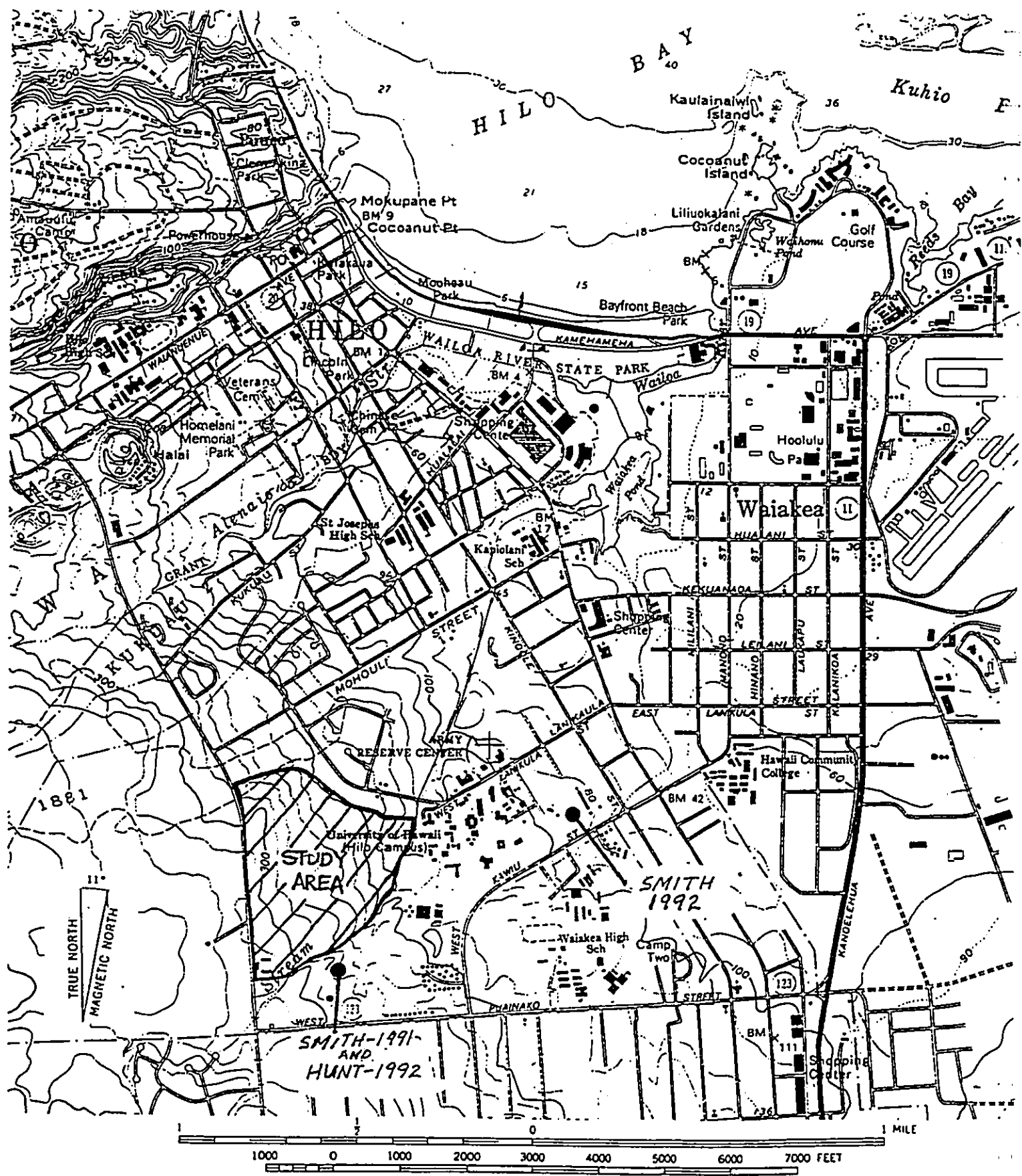


Figure 7 Portion of USGS Topographic Map, Hilo Quadrangle Showing Areas of Study Adjacent to the Present Project Area

Field inspections were conducted by Mr. Marc Smith, a staff member of the State Historic Preservation Division of the Department of Land and Natural Resources (SHPD/DLNR). The locations of the inspections include portions of the present study area and an undeveloped lot (Waiākea Cane Lots) abutting Ululani St.

Field inspections in to the present study area were conducted in October 1991. The impetus for these inspections were "calls from concerned students and faculty of University of Hawaii-Hilo about the possible presence of historic sites in the proposed Research & Technology Park" (SHPD/DLNR 5/7/92). Marc Smith conducted three separate field checks, October 18, 24, and 27, 1991. Observed during the field checks were a number of historic sites including "large faced platforms, modified outcrops, enclosures which may be house sites, and a large walled enclosure" (Smith 11/8/91).

Additionally, Smith noted three different lava flows in the area. The flows include: 1) a portion of the 1881 Mauna Loa pahoehoe flow; 2) a pahoehoe flow "dating to 1.5 - .75 KA (1,500 to 750 B.P)"; and 3) the oldest flow which has "a more level soil surface" and dates to ">4,0 KA (greater than 4,000 B.P.)" (*Ibid.*). The lava-flow age determinations are based on work by Lovelace as referenced in Marc Smith's letter.

The age of the flows has a direct correlation to site distribution. The only sites observed were "on the >4,000 year old flow," except one site which "appears to be constructed along the margin of the 1,500-to-750-year-old flow, suggesting others may exist" (Smith 11/8/91). Based on the field checks it was recommended that an inventory survey be conducted for the proposed area of the construction of utilities.

In December 1991 Marc Smith (SHPD/DLNR) conducted a field inspection for the proposed Department of Water Supply Office project site. The project area, bounded by Ululani, Kawili, and Kapiolani Streets, is located within the former "Waiākea Cane Lots"



with "apparently the same soil type and flow underlying archaeological site types recorded above the University of Hawaii Hilo in the proposed Research and Technology Park" (Smith, 1/3/92). Observed within the parcel were "several stacked stone walls and linear mounds, ... a large rectangular enclosure ... several wall remnants and C-shapes" (*Ibid.*). An inventory level survey was recommended prior to any land disturbance.

The survey for the proposed Puainako Street Extension (Hunt 1992) covered an area approximately 150 ft. wide from the 200 to 1500 feet in elevation, through "multiple *ahupua'a* including Waiākea, Kukuau 1 and 2, and a small part of Ponoehawai" (*Op. cit.*:5). A total of 48 sites were observed and recorded. Site types included "walls, mounds, platforms, and faced terraces" (*Op.cit.*:9). The highest concentration of sites is "in one area... Alternative B (Lower section) near the University of Hawaii-Hilo" (*Op.cit.*:11). This cluster of sites, which "appear to be associated with Hawaiian occupation and cultivation along the intermittent drainage during prehistoric and historic times" (*Ibid.*)<sup>1</sup>, includes some of the same sites observed by Marc Smith during his field inspections of the proposed Research and Technology Park (Smith 11/8/91). The sites are situated within the former Waiākea Cane Lots and also appear to be on the same soil-mantled lava flow (i.e., >4,000 B.P.) as described by Marc Smith (Smith 11/8/91 and 1/3/92).

Based on the field checks by Smith and survey by Hunt, the site distribution (including that within the present study area) correlates to the lava-flow ages. The three different ages and relative degrees of soil development include: 1) a small portion of the 1881 flow with no soil cover or development; 2) the 1500-to-750-year-B.P. pahoehoe flow with no soil or weathering-related development but with some pockets of organically derived soil (i.e., leaf litter) - this flow covers the majority of the study area; and 3) the soil-mantled >4,000- year B.P. flow. Archaeological sites within and near the present

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<sup>1</sup> Additional survey and archival findings showed all sites to be plantation era structures (Hunt 1994)

study area are confined to the oldest, soil-mantled flow associated with the former Waiākea Cane Lots. Site types, function and probable ages have ranged from agricultural mounds and platforms, habitation enclosures, and platforms with both prehistoric- and historic-era usage hypothesized.

Based on the information gathered from the field inspections and reconnaissance-level survey discussed above, three expectations regarding site distribution in the current study area can be stated. First, the 1881-flow portion of the study area would contain no sites. Second, the 1500-to-750-year-old pahoehoe flow comprising the majority of the study would contain few sites concentrated along the perimeter or edge of the flow. Third, the oldest flow would contain a higher site density with the understood possibility that earlier (i.e., prehistoric) sites might have been altered for commercial sugar cane cultivation.

## SURVEY RESULTS

### Methodology

The study area was surveyed by traversing the property on foot. The dense vegetation in disturbed areas was a seriously inhibiting factor in visibility, horizontally as well as of the actual ground surface.

The most difficult vegetation to survey through was *uluhe* or false staghorn fern which predominated in the western portion of the study area especially between Komohana Street and the existing "Road B" alignment that extends to the south of existing "Road A" as a previously bulldozed strip. Range of the *uluhe* conforms closely with the reconnaissance soils type of rLW or pahoehoe lava, and with the mechanically disturbed areas. North-south traverses were pushed through the forest north of "Road A" (Figure 8), and east-west traverses through the triangular parcel delineated by Komohana Street, "Road A", and the previously bulldozed powerline easement. The *uluhe* covers as much as 70 percent of this area *mauka of the "Road B" alignment*.

Roughly east-west traverses were walked through the remaining land east or *makai* of "Road B" and north of the powerline easement. The existing "Road A" and the powerline easement were used to guide on through the dense stand of strawberry guava (*Psidium cattleianum*) which covers this portion of the study area. The trees grow on the average less than 12 inches apart making passage extremely difficult, but are only one to 4 or 5 centimeters thick and visibility is surprisingly good. One can see a minimum of 20 to 30 feet horizontally and the ground underfoot is clear except for leaf litter and sphagnum moss on the unweathered pahoehoe lava of low undulating topography.

East-west traverses were also made through the lands south of the powerline easement, which completed the coverage of the entire study area. The undeveloped

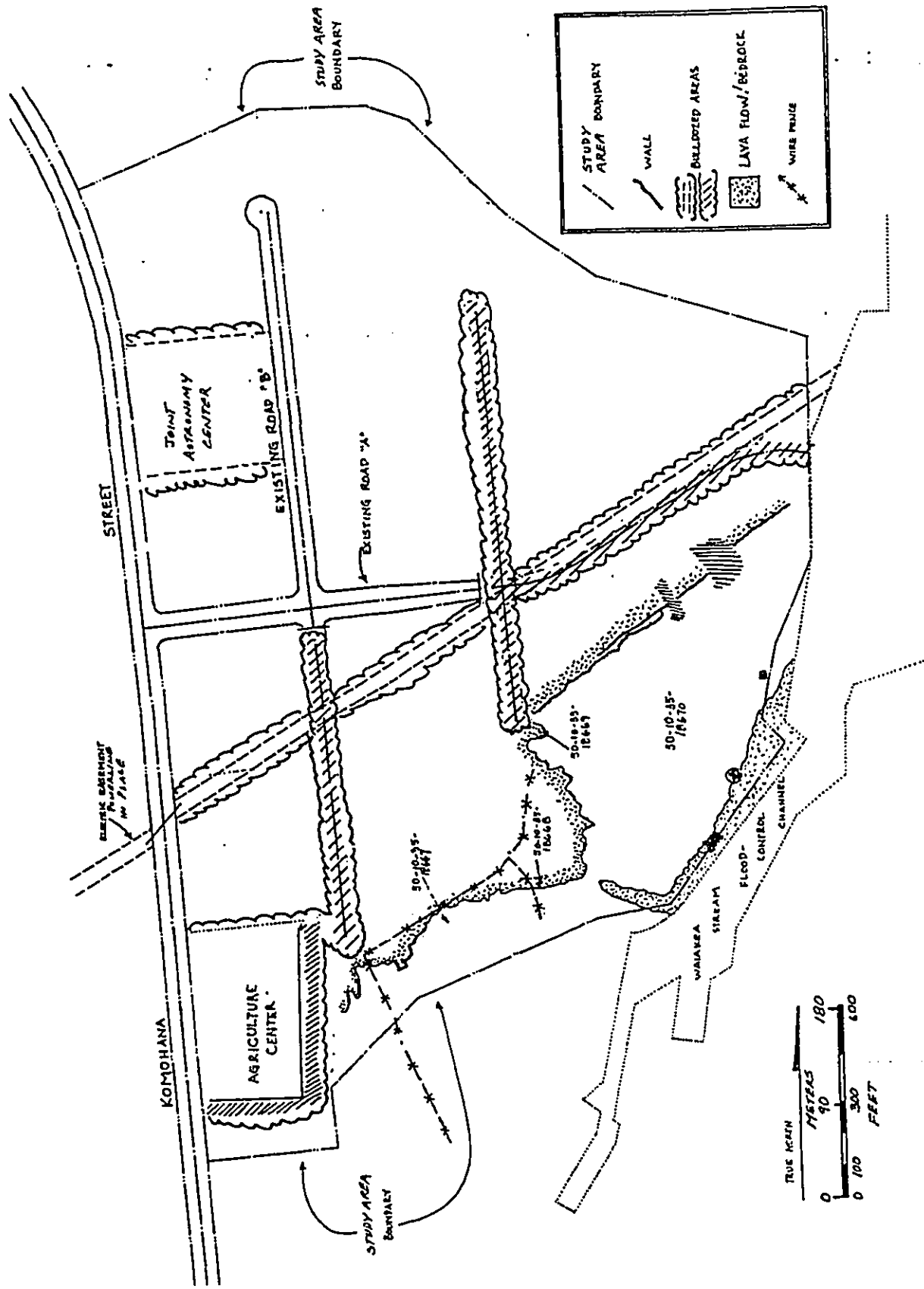


Figure 8 Study Area, Showing Existing Roads, Powerline Easement and Areas of Previous Bulldozing

portion of this land between Komohana Street, the powerline, and the bulldozed extension of the "Road B" alignment is covered with *uluhe*. The undeveloped southern extension of "Road B" and a portion *makai* have been bulldozed and since revegetated. Going *makai* on the south side of the powerline the ground underfoot changes to the undisturbed, little weathered pahoehoe lava supporting the strawberry guava thicket, and visibility of the ground becomes good again.

Traverses throughout the study area were done by two to six individuals at intervals from one another of 20 feet to 100 feet depending upon vegetation.

Test excavations were done and the testing process included: pre-excavation photographs, removal of rocks from the specified test unit; excavation of soil by natural stratigraphic layer (or 10 cm. level within natural strata); screening of all soil sediments through 1/8" mesh screen; recovery of all cultural material (artifacts, midden, charcoal); one profile and stratigraphic description per unit; post excavation photographs; and reconstruction of test unit locale.

The site of the existing School of Agriculture is at the southwest corner of the study area. The Waiakea Stream floodplain and its associated alluvial sediments extends along the southern study area boundary widening to *makai*. This is the old sugarcane field and vegetation here is larger guava trees with almost no understory. As much as 90 percent of the ground is bare with excellent visibility.

### **Fieldwork**

The archaeological survey and testing located archeological sites in the southern portion of the study area. Four sites were described and mapped to scale. Two of the sites - 18668, and 18669 - and a mound-feature within a third site - 18667 - were tested by hand excavations to document stratigraphy in the sites and to search for cultural

remains to help in dating the sites.

The larger of the sites are two (2) expansive historic, agricultural fields (sites - 18667 and -18670) bounded by low rock walls and fences that follow the natural boundaries of stream bank and unweathered lava flow (Figure 9). Field-rock clearing mounds are dispersed throughout both fields. The two other sites identified were assigned State site numbers 18668 and 18669 and were tested by excavation. These latter two sites each have a low wall defining their interiors and have historic bottles on the surface within the sites. The sites and the test excavation results are described in detail in the following Site Descriptions section.

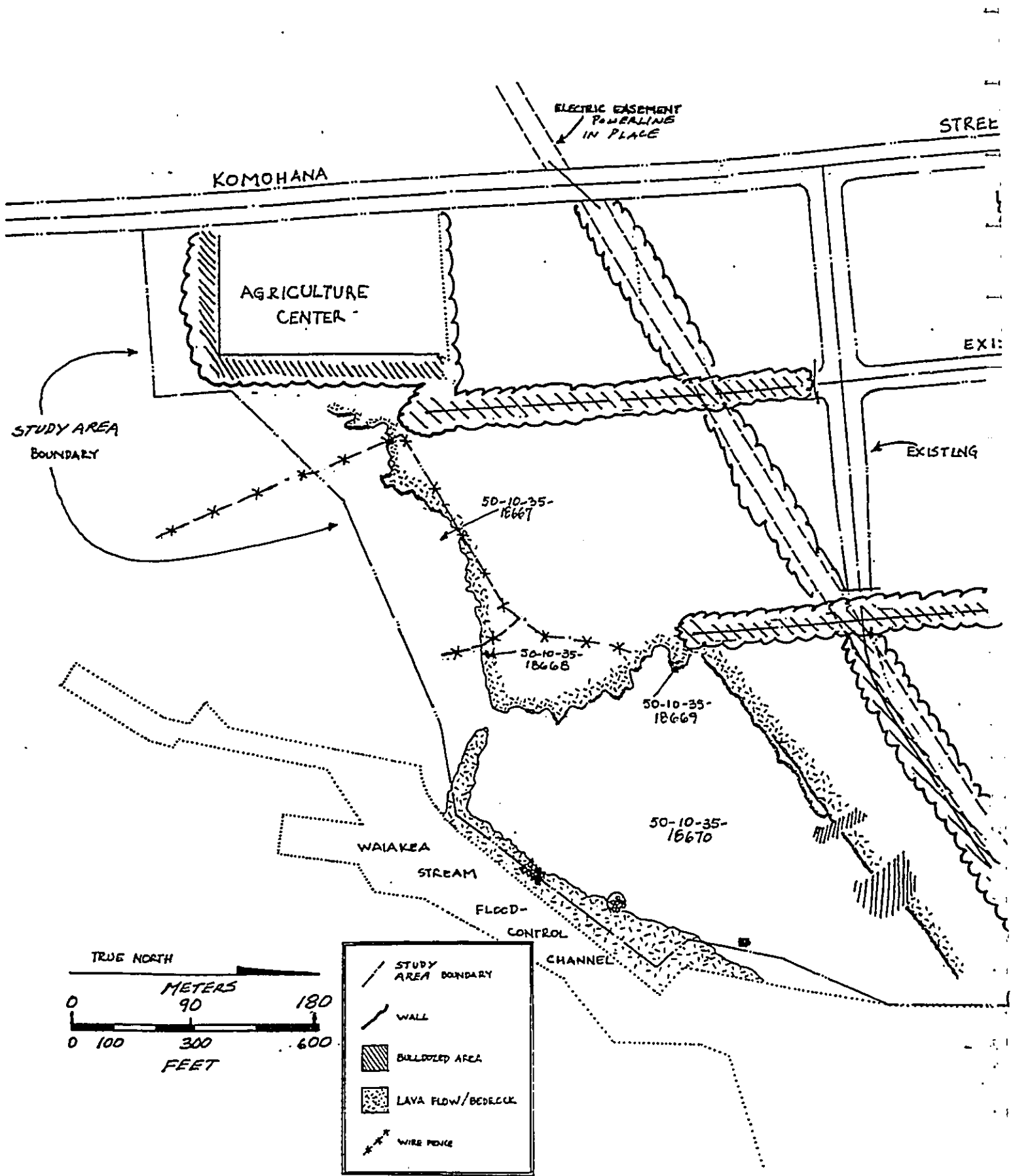


Figure 9 Portion of Study Area Showing Archaeological Sites

## SITE DESCRIPTIONS

The table below summarizes the basic site information. It is followed by a detailed description of sites.

Table: Site Summary of Survey Area

State Site #50-10-35-	CSH Site #	Site Type	Function	Significance	Age	Recommen
18667	10	Field Complex	Agriculture	D	Historic	NFW
18668	11	Enclosure	20 century camp	D	1900s	NFW
18669	40	Enclosure/Wall	Lunch station	D	1900s	NFW
18670	12&13	Field	Agriculture	D	1900s	NFW

D - Site may be likely to yield information important in prehistory or history  
 NFW - No Further Work

**CSH Site: 10**

**State Site #** 50-10-35-18667  
**Site Type:** Field Complex  
**Function:** Agriculture  
**Features (#):** 3  
**Dimensions:** 6500.0 m<sup>2</sup> (21325.2 ft<sup>2</sup>)

**Description:** Site 18667 (Figure 10) is a large area consisting of two discontinuous and separate walls and numerous (approx. 25) mounds. The site is located in the southwest corner of the study area and Feature A, a wall, in part runs along the study area boundary. To the south of Feature A, outside of the study area, there is what appears to be an old stream gulch. A large undulating expanse of guava forested terrain lies to the north of Feature A - dotted intermittently by mounds (Feature B). Feature C is a wall





which runs roughly parallel to Feature A but is generally more discontinuous and in poorer condition than Feature A. Feature C lies between 40-60 m. (131.2 ft. to 196.8 ft.) to the north of Feature A. The mounds are located between the walls.

Feature A is a long and discontinuous wall which runs along the upper bank of the old stream gulch. Feature A is oriented roughly northeast/southwest. The entire length of Feature A measures approximately 140.0 m. (459.2 ft.). The wall is generally well-faced to the downslope side, toward the stream. Facing in these sections measures to a maximum height of 1.5 m. (4.9 ft.). Several constructed breaks exist along the wall and appear to serve as pathways through the wall to the stream. Toward the northeast end of the feature the wall becomes thicker and resembles narrow platforms or "ramparts." The wall varies in width from 1.0 m. (3.3 ft.) to 3.0 m. (9.8 ft.) at the "ramparts."

Parallel sections of wall lie to the south of Feature A. One parallel section is located at the southwest end of Feature A in the stream bottom and runs approximately 35.0 m. (114.8 ft.) long, at a distance of 10.0 m. (32.8 ft.) south of Feature A. A second parallel section is located approximately midway along the length of Feature A. This section measures 10.0 m. (32.8 ft.) long and is nearer the top edge of the stream bank.

No midden or artifacts were observed.

Feature A is in fair condition and excavation potential is poor.

Feature B comprises approximately 25 mounds - located primarily between Features A and C. The mounds vary in both size and formality of construction. Several of the larger mounds are well-faced and measure up to 4.0 m.<sup>2</sup> (43.0 ft.<sup>2</sup>). The mounds are arranged randomly; they do not appear to be aligned in rows. The mounds of Feature B range in height from 0.6 m. (2.0 ft.) to 1.4 m. (4.6 ft.). Feature B mounds are probably agricultural clearing mounds.

No midden or artifacts were observed.

The mounds of Feature B are in fair condition and excavation potential is poor (see Testing Results and Figure 11).

Feature C is a second wall feature located to the north of Features A and B. Feature C runs roughly northeast/southwest, but unlike Feature A, this wall follows the edge of a pahoehoe flow. Pahoehoe outcropping connects the discontinuous segments of Feature C. The construction of Feature C is poor compared to Feature A and less vertical facing was observed. Feature C measures approximately 70.0 m. (229.6 ft.) long and ranges in width from 1.0 m. (3.3 ft.) to 2.0 m. (6.6 ft.). The heights range from 0.4 m. (1.3 ft.) to 1.0 m. (3.3 ft.).

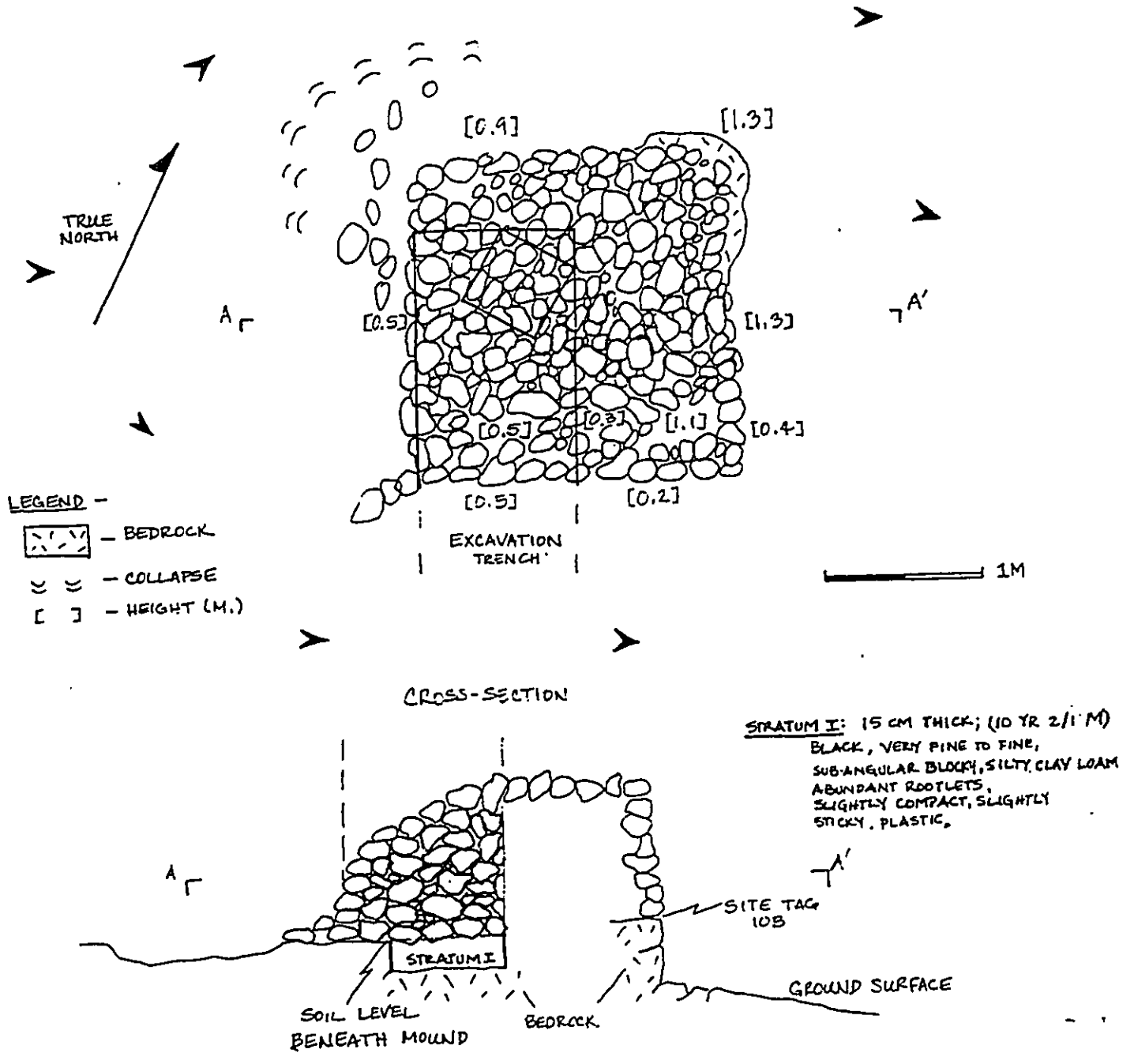
No midden or artifacts were observed.

Feature C is in poor condition.

Site 18667 complex is agricultural in function, but the age of the site is difficult to determine. However, based on historical information concerning field boundaries of the Waiākea Mill Co. it would appear that this complex represents sugar cane cultivation practices.

### Testing Results

Subsurface testing was conducted at Site 18667, Feature B (See Figure 11), in an effort to better interpret site function. A 1.0 by 1.5 m. trench was placed in a single mound of Feature B. The excavation demanded that the mound be disassembled. No



**Figure 11** Site 50-10-36-18667 Feature B, Plan View of Mound (Top), and Cross Section Showing Stratigraphic Relationship of Rock Mound to Sediments (Bottom)

midden or artifacts were encountered through the mound construction. At the base of the mound was exposed bedrock and soil. The excavation continued through the 15 cm. thick deposit of soil (Stratum I) until bedrock was encountered there also. Stratum I (Munsell 10 YR 2/1 black) consisted of very fine to fine subangular, blocky, firm, slightly compact and sticky, silty clay loam. No midden or artifacts were observed. The mound was reconstructed subsequent to recording the excavation data. The excavation confirmed the rock clearing functional interpretation.

**State Site #:** 50-10-35-18668  
**Site Type:** Enclosure  
**Function:** 20th century camp  
**Features (#):** 1  
**Dimension:** 24.0 m.<sup>2</sup> (258.2 ft.<sup>2</sup>)

**CSH Site #: 11**

**Description:** Site 50-10-35-18668 (Figure 12) comprises an oval enclosure and adjacent L-shaped wall segment located on the edge of undulating pahoehoe terrain. In the site area, there are shallow soil deposits supporting moderately dense strawberry guava trees, ferns, three mango trees, and one royal palm tree.

The enclosure is a single course alignment of pahoehoe stones measuring 4.0 m. (13.1 ft.) N/S by 3.0 m. (9.8 ft.) E/W. The height of the alignment above the ground surface measures 0.1 m. (0.3 ft.). A pahoehoe outcrop ridge is located to the northeast of the enclosure and is approximately 1.0 m. (3.3 ft.) high. See **Testing Results** below.

The adjacent L-shaped wall segment lies directly south of the enclosure. The long leg of the wall measures 2.4 m. (7.9 ft.) long N/S and the short leg of the wall extends 1.8 m. (5.9 ft.) to the west from the long leg's south end. The wall measures 0.4 m. (1.3 ft.) thick and (2 to 3 courses) 0.8 m. (2.6 ft.) high, maximum.

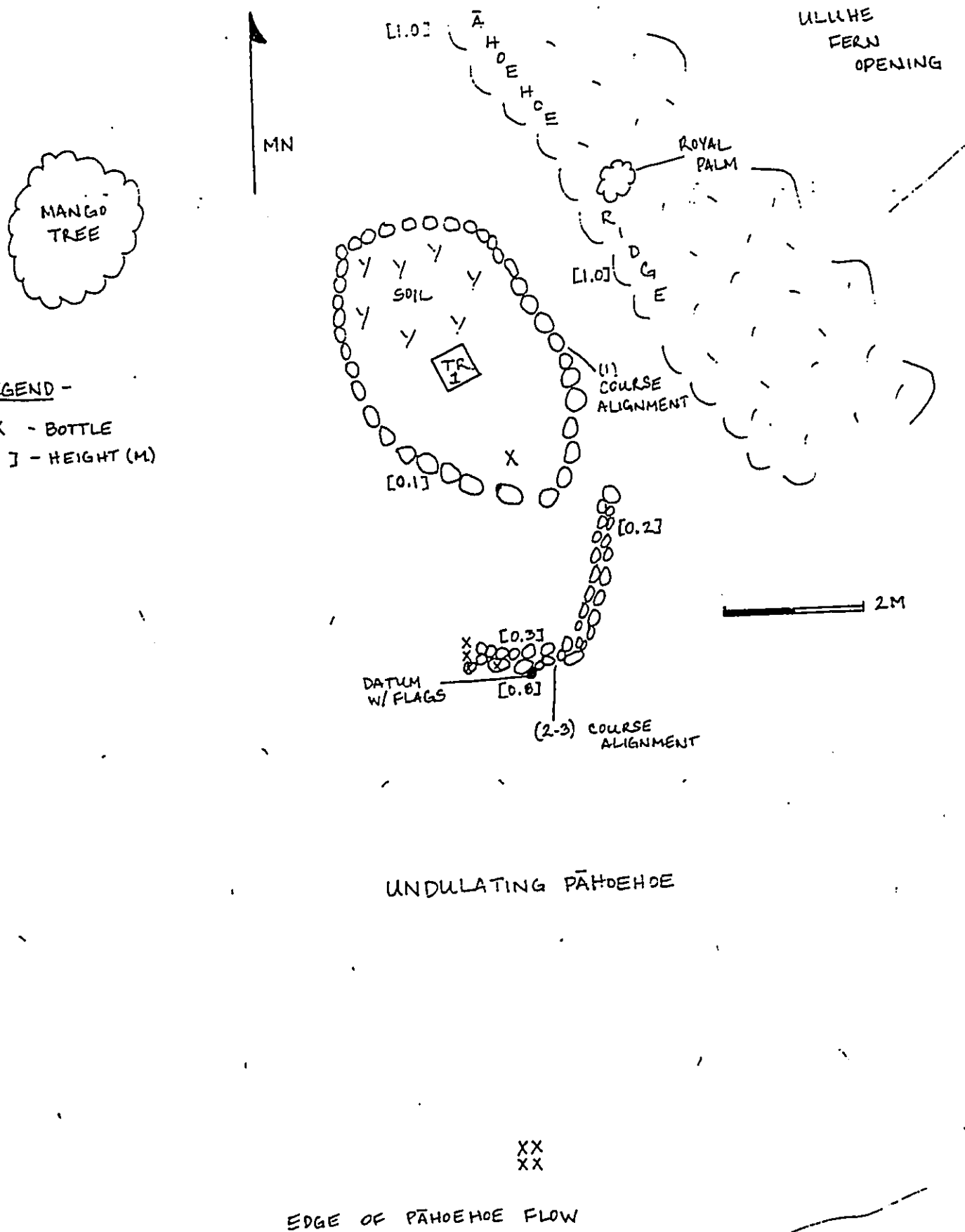


Figure 12 Site 50-10-35-18668, Plan View Showing Excavation Unit

No indigenous artifacts or midden were observed. Several clear and brown liquor glass bottles were observed at this site.

Site 18668 is probably a temporary camp with the oval single course alignment representing the perimeter of a tent pitching site.

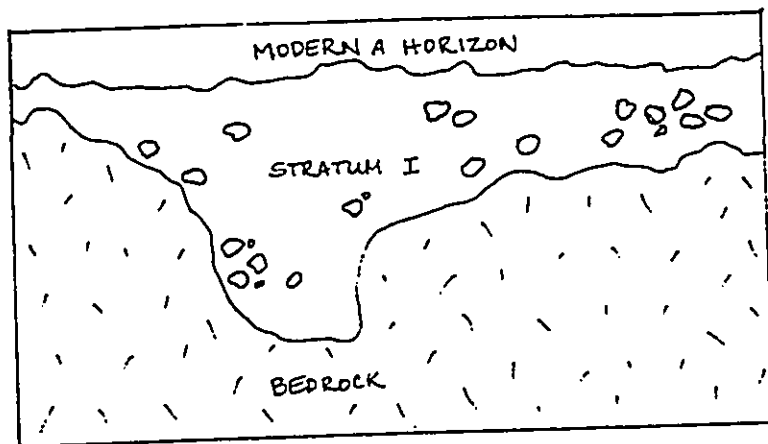
### Testing Results

Subsurface testing was conducted at Site 18668 (Figure 13). A single 0.5 m. by 0.5 m. trench was placed in the center of the enclosure. The trench was excavated through 4 cm. of modern forest litter and through Stratum I to a maximum depth of 25 cm., where bedrock was encountered. Stratum I measured between 4 to 25 cm. below the ground surface. Stratum I consisted of a dark brown to black, compact, moist, silty clay. The soil was organized into small (5 mm. diameter) peds or grains. There was high root and rootlet intrusion. Approximately 10% of Stratum I consisted of small pahoehoe cobbles. No cultural material was observed in this trench.

<b>State Site #:</b>	50-10-35-18669
<b>Site Type:</b>	Site complex
<b>Function:</b>	Lunch station
<b>Features (#):</b>	2
<b>Dimension:</b>	224 m. <sup>2</sup> (2409.9 ft. <sup>2</sup> )

**CSH Site #: 40**

**Description:** State site 18669 (Figure 14, top) is a site comprised of an enclosure and a wall segment, designated Features A and B. The site is located in gently sloping terrain of moderately deep soil deposits. Vegetation at the site includes guava, ti, royal palm, and hibiscus.



STRATUM I: 25 CM. THICK; BLACK-DARK BROWN, COMPACT, STRUCTURELESS, MOIST, ROOTS AND ROOTLETS ABUNDANT, 10% COBBLE INCLUSION; NO CULTURE

**Figure 13** State Site 50-10-35-18668, Trench 1 Profile: East Face



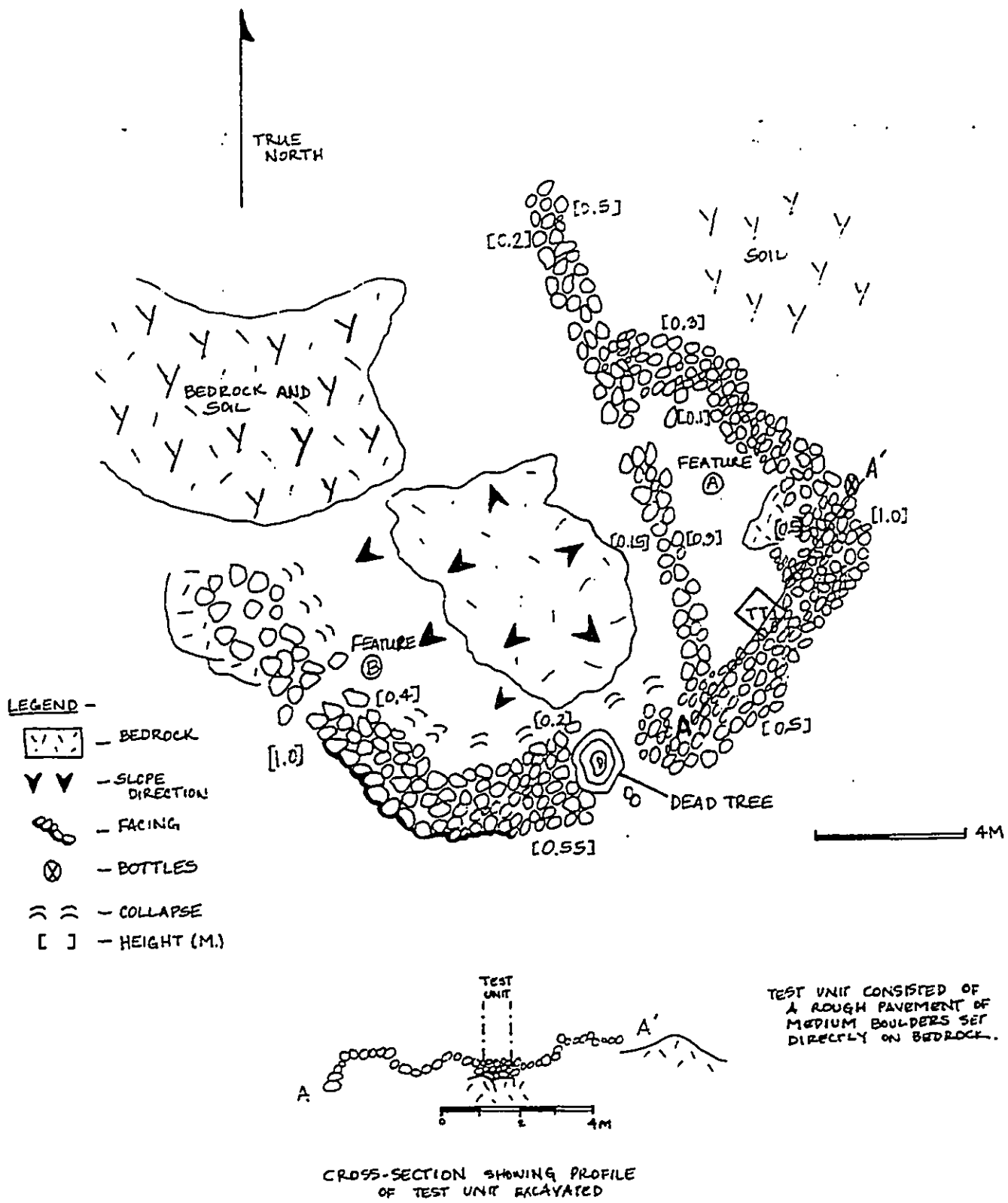


Figure 14 Site 50-10-35-18669, Plan View and Cross Section Showing Excavation Unit

**Feature A** is a rough, irregular, modified outcrop enclosure, measuring 11.0 m. (36.1 ft.) N/S by 6.4 m. (21.0 ft.) E/W. The walls of this enclosure are generally thick, measuring 1.8 m. (5.9 ft.) maximum, and 1.0 m. (3.3 ft.) average. A maximum wall height of 1.0 m. (3.3 ft.) is measured at the south exterior side of Feature A. The interior of the enclosure consists of a shallow soil deposit covering bedrock. At the north end of the west wall there is a constructed break measuring 0.75 m. (2.5 ft.). A 4.0 m. (13.1 ft.) long wall extends to the northwest off of the north corner of Feature A. See **Testing Results** below.

**Feature B** is a wall extension contiguous to the southwest corner of Feature A. The wall extends west for 6.0 m. (19.7 ft.) then doglegs to the north for an additional 2.3 m. (7.5 ft.). The wall measures 2.0 m. (6.6 ft.) thick, and 1.0 m. (3.3 ft.) high. A pahoehoe outcrop lies between Features A and B.

No midden was observed but Soda bottles, three railroad ties, and barbed wire were present at this site.

Site 18669 is in fair condition.

### **Testing Results**

Subsurface testing was conducted at Site 18669, Feature A (Figure 14, bottom). A single 1.0 m. by 0.8 m. trench was placed in Feature A, against the south wall, near a concentration of 7 "Pacific Sodaworks" bottles. A single soil layer was present, Stratum I, which ranged in depth from 10 to 25 cmbs. Stratum I consisted of a very dark brown (Munsell 10YR 2/2) silty clay soil, slightly compact, and organized into small blocky grains or peds. No cultural materials were observed.

**State Site #:** 50-10-35-18670  
**Site Type:** Field  
**Function:** Agricultural  
**Features (#):** 1  
**Dimension:** 36.0 m.<sup>2</sup> (387.3 ft.<sup>2</sup>)

**CSH Site #: 12&13**

**Description:** Site 50-10-35-18670 (refer to Figure 9) is a remnant of a commercial sugar cane agricultural field. This site is defined by a pahoehoe lava flow to the north and west by a stream gulch to the south. The lava flow and stream gulch converge at both *mauka* and *makai* ends of the site area, resulting in an "almond" shape. The site is generally level with undulations following the pahoehoe substrate. The field area has a substantial soil deposit and moderately dense guava and fern vegetation. There are also some isolated royal palm trees in areas where pahoehoe bedrock is exposed

The site area is characterized by long, shallow, and narrow furrows, oriented generally north/south (cross-slope). This cross-slope orientation of the furrows suggest that contour plowing to reduce erosion was being utilized. The furrows measure, from trough to trough, 1.4 m. (4.6 ft.) wide and 0.2 m. (0.7 ft.) deep.

Within the site area there are subfeatures indicative of rock-clearing activity. One subfeature is a square enclosure located in level pahoehoe lava terrain (Figure 15). The enclosure measures 7.0 m. (23.0 ft.) N/S by 6.5 m. (21.3 ft.) E/W. The north and south sides of the enclosure are natural, raised pahoehoe outcrop ridges, measuring 0.7 m. (2.3 ft.) high. The east and west sides are constructed of pahoehoe boulders and cobbles, measuring 0.8 m. (2.6 ft.) thick and to a maximum height of 0.55 m. (1.8 ft.). A constructed break in the west wall measures 1.2 m. (3.9 ft.) wide. Three royal palms are growing within the enclosed area. A single plastic milk crate (Foremost 1979) was observed 3.4 m. (11.2 ft.) to the south of the enclosure.

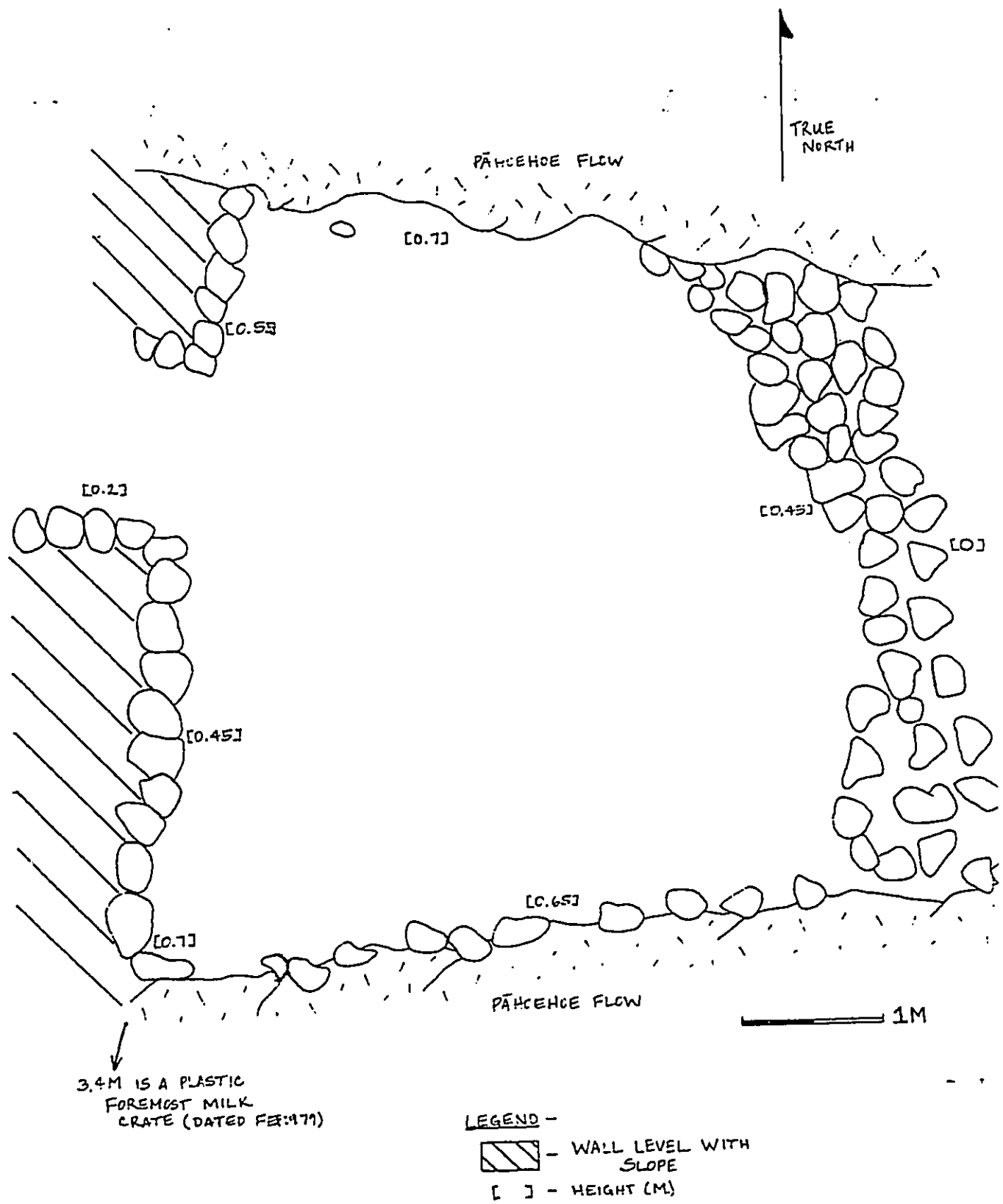
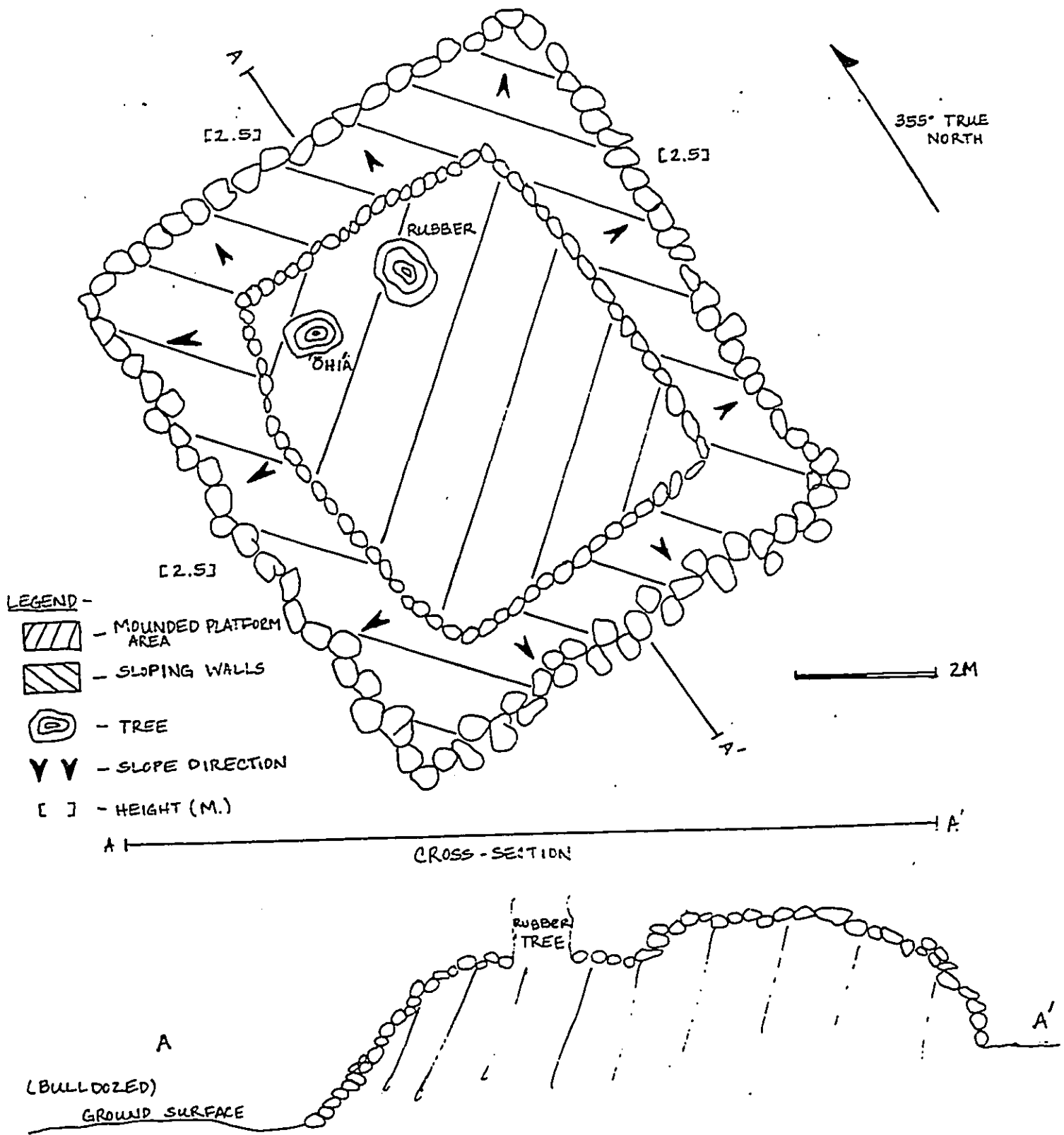


Figure 15 Enclosure Sub-Feature of Site 50-10-35-18670 (CSH12)

Another subfeature (Figure 16) example of rock-clearing is a large, rectangular mound. The mound measures 8.2 m. (26.9 ft.) N/S by 7.5 m. (24.6 ft.) E/W. The top of the mound surface measures approximately 2.5 m. (8.2 ft.) above the surrounding ground surface. Some vertical facing still exists though most of the sides are somewhat collapsed.

Approximately 14 other amorphous rock clearing features exist within the field. These consist of mounds, piled rocks on bedrock ledges and in one case a pile of rocks within a shallow bedrock drainage channel. A large banyan tree grows out of the piled rocks at the head of the channel.

Based on historic research including a review of the Waiākea Mill Co. map (See Fig. 6 in Cultural History Section) Site 18670 field was once Cane Lot #16. Lot 16 encompassed some 22 acres of which .13 was "waste" or areas of rock (i.e., clearing mounds, etc.).



**Figure 16** Larger Rock Clearance Mound within Site 560-10-35-18670, Plan View and Cross Section

## SUMMARY AND SIGNIFICANCE

Archaeological survey of the land area *mauka* of the University of Hawaii at Hilo Campus has located definitive evidence that the agriculturally productive land there was plowed and planted in sugar cane as recently as the 1940s. Furrows are still visible in the tillable lands that comprise the south end of the study area, and a sample of the rock mounds tested by excavation contained no cultural material. Stratigraphically the mounds are built upon the sediments of the fields or upon shallow bedrock up-croppings, thus are contemporaneous with sugar planting in the study area - in all probability field-rock clearing mounds. The entire field is bounded by a continuous low rock wall. Along the north field boundary the wall follows the natural edge of tillable soil, delineated by the edge of a pahoehoe flow which has not weathered significantly from its original state. The wall along the south boundary of the field follows the natural edge of the old bed of Waiākea Stream. This wall is essentially the south boundary of the study area. At the west (*mauka*) and east (*makai*) ends of the field the wall is disturbed by the rerouting of the Waiākea Stream bed and construction of the School of Agriculture building, and by the flood control 'improvements' to the stream bed, respectively.

Two small sites - 18668 and 18669 - located along the northern fringe of the tilled land were tested and were found to contain no stratified deposits or cultural material below the surface. On the surface within the sites were twentieth century bottles, for whiskey and soda water at sites 18668 and 18689 respectively. These sites are interpreted as lunch stations - temporary or single use sites - of the sugar field workers, homesteaders, or possible the cowboys or mule skinnners associated with the pasture land.

Site 18667 is nothing more than the constricting *mauka* end of the sugar field.

Furrows were not observed on the bare ground here, which is the primary reason for differentiating it from the *makai* portion of the field. The ubiquitous field-rock clearing mounds are more numerous, but smaller, generally no larger than 2 meters by 2 meters square with maximum heights of and a meter and a half. Their stratigraphic relationship to the surrounding sediments is similar to the mounds in the *makai* portion of the field, that is, of recent historic age and without any cultural material to suggest they are anything other than clearing mounds.

The entire remaining portion of the study area contained no cultural resources related to archaeology. This land is comprised mostly of a pahoehoe lava flow little altered by weathering. Vegetation is supported primarily by quantities of humus and leaf litter deposited by gravity in the low basins of the lava flow's undulating surface, their roots finding moisture ponded in the basins or deep in the natural cracks and fissures of the lava sealed by a thick, but discontinuous carpet of sphagnum moss. It is likely that prehistoric use of this land was for collection of feral or wild plants and animals. Variation between this pahoehoe lava of old and the lavas of the 1881 flow that entered the study area at the northwest corner is not clearly discernable due to the mechanized land alteration and the present heavy, ground-obscuring vegetation.

#### Significance

Archaeological remains in the study area, which are limited to the southern portion where old sediments are present, are borderline to even be considered historical properties in that they were last in use at least as recently as the mid-1940s. Initial homesteading of these "cane lots" occurred around 1918. So it is possible that construction of some of the field-stone clearing mounds had been begun by this time, and the mounds could have



been continuously added to through the years as is the nature of such mounds.

Nevertheless, based on the archaeological mapping of the fields, and the testing results of type-mounds we believe all of the archaeological sites and features within the study area to be without other significance than Criterion D (i.e., site is likely to yield information important to prehistory or history) as historical properties, according to National Register significance and State Historic Preservation Division draft rules on significance criteria.

#### Recommendations

Archaeological work accomplished includes, scale mapping of the limits of the cane field and its boundary walls, testing of two peripheral sites, and testing of a field-stone clearing mound feature. Thus, it is felt sufficient data has been collected, analyzed, and reported on to satisfy Criterion D. Therefore, no further archaeological work is recommended for the study area.

Archaeological monitoring is not recommended for site grading and preparation work or other construction activities, based on the results of the archaeological survey and testing in the study area. However, as is the general case with historic preservation concerns in the event inadvertent discoveries are made during any phase of construction the State Historic Preservation Division shall be notified in each incidence to determine an appropriate course of action for mitigation.

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SUPPLEMENTAL ARCHAEOLOGICAL SURVEY

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**Appendix C**

**Supplemental Archaeological Survey  
and Testing of the Proposed University of Hawaii  
at Hilo Expansion Area  
(TMK 2-4-01:19)**

by

Douglas F. Borthwick, B.A.  
and  
Hallett H. Hammatt, Ph.D.

for

**Engineering Concepts**

by

Cultural Surveys Hawaii  
November 1993

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## INTRODUCTION

Cultural Surveys Hawaii conducted, at the request of Engineering Concepts, an archaeological inventory survey of an approximately eleven (11) acre parcel located adjacent to the proposed U.H. Hilo Research and Technology Park. The purpose of the survey was to locate and describe any archaeological sites and/or features within the specific area through which infrastructure-related construction is proposed.

The present inventory survey project area is situated along the Waiakea Flood Control Channel adjoining (to the east) the larger parcel of the Research and Technology Park previously surveyed by Cultural Surveys Hawaii (Borthwick and Hammatt 1993) (Fig. 1). The need to conduct this additional survey was reached after survey and report production of the larger parcel was completed. The present research is thus included as a supplemental report to the previous Cultural Surveys Hawaii's study which detailed background research pertinent to the entire Research and Technology Park.

## SURVEY RESULTS

### Methodology

The present inventory survey was conducted by two archaeologists, Douglas Borthwick and Dr. Hallett H. Hammatt on Sept 30, 1993. The first phase of the survey included walking roughly north/south-oriented transects to locate any archaeological sites. The space between archaeologists during the transects was never greater than 15 meters and averaged 10 meters. The entire area was covered in four transects. The vegetation ranged from fairly dense grass-covered areas to open terrain under Royal Palms and/or Guava, thus ground visibility ranged from fair to good. A portion of the Waiakea Flood Control Channel is encompassed within the project area. The channel and associated

land alterations generally define the southern and eastern boundaries of the project area. The northern boundary is a bulldozed swath related to existing water and overhead power lines. The western or *mauka* boundary is a surveyed line marked by survey flags, from the previous Cultural Surveys Hawaii's project, and more recently survey work by R.M. Towill Corp. The contour and boundary map developed by R.M. Towill's work was utilized to accurately plot site locations (Fig. 2).

Test excavations were conducted at two rock mounds. The testing process included: pre-excavation photographs, removal of rocks from the specified test unit; excavation of soil by natural stratigraphic layer (or 10 cm. level within natural strata); screening of all soil sediments through 1/8" mesh screen; recovery of all cultural material (artifacts, midden, charcoal); one profile and stratigraphic description per unit; post excavation photographs; and reconstruction of test unit locale.

## Results

Survey of the flood control channel and the area to the east of the channel, indicated that this portion of the project area had been entirely mechanically altered. Mechanical alteration includes bulldozing, cut and fill, and channel embankment construction. Due to these modern alterations no archaeological sites exist within the channel or along the channel's embankment, including the area between the eastern embankment and the existing UH Hilo structures. The existing U.H. Hilo structures include dormitories and associated grounds (i.e., parking lot and landscaped areas).

West of the flood channel four rock clearance mounds and a rock wall were observed and plotted on the survey map (See Fig. 2). The mounds range in size from a





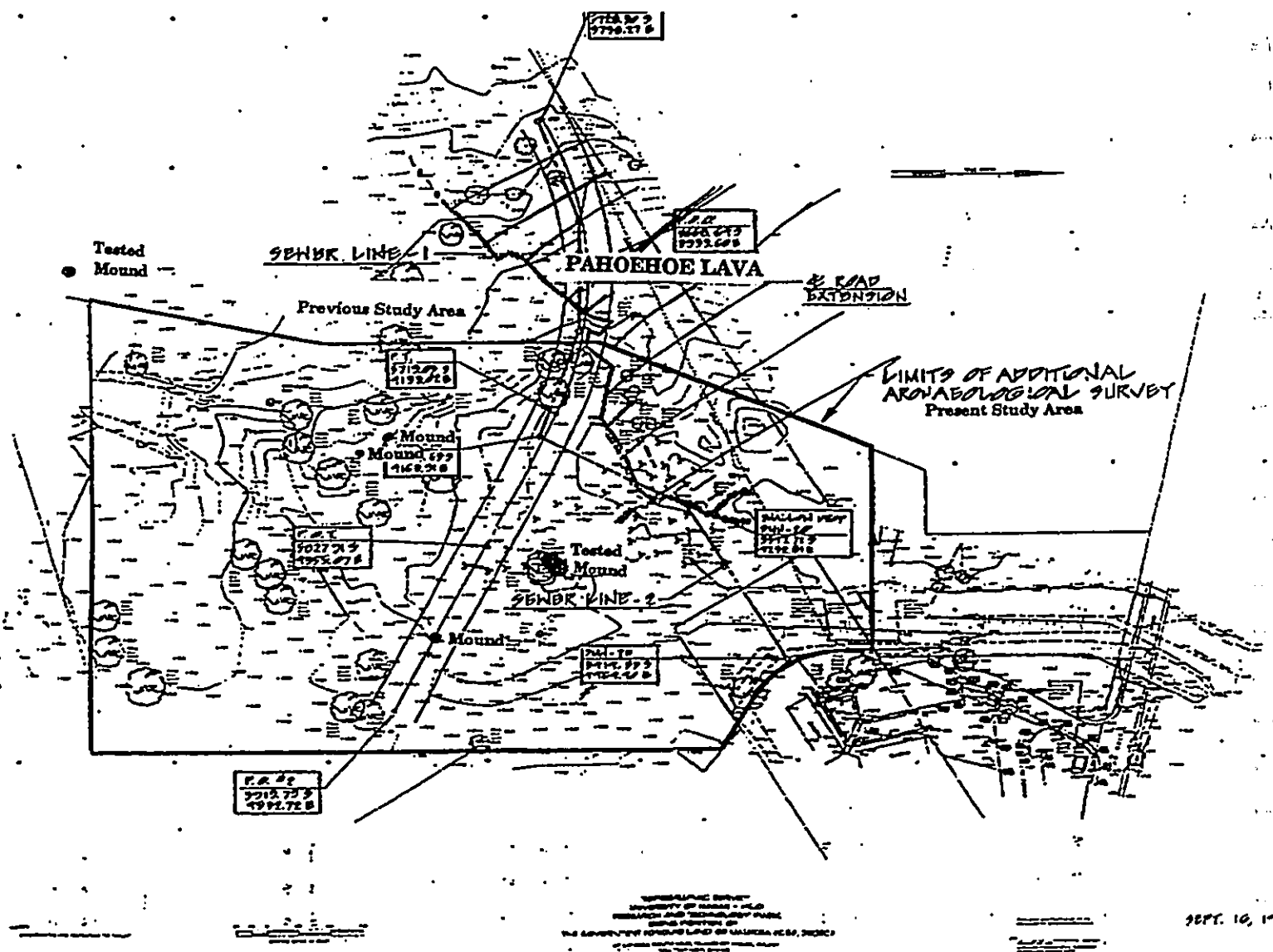


Fig. 2 Project Area Map Showing Archaeological Features



maximum of 5 meters by 10 meters to 2 meters by 6 meters. The mounds are constructed on high points (i.e., bedrock undulations) in the mostly soil terrain where former cane furrows are still visible. The wall observed, which is of mounded construction, is the *makai* extension of the wall noted and described previously (Borthwick *et al.* 1993:25-27, and 43) (See Fig. 3). The wall defines the interface between soil-mantled terrain to the south, which was formerly under commercial sugar cane cultivation and the non-cultivated soil-less pahoehoe terrain to the north. The wall varies greatly in condition and size throughout its length but averages 1.5 m. wide and .50 m. in height.

The largest, most visibly distinct of the four newly identified mounds, was mapped to scale (Fig. 4), photographed and subjected to limited surface testing. A 1 m. by 2 m. test unit was excavated into the roughly faced west edge of the mound. The excavation revealed a maximum thickness of rock construction of 50 cm. The construction was of loosely piled boulders, of fairly consistent size (15-25 cm. in diameter), with no filtered soil matrix. No cultural material (artifacts, midden, or charcoal) was present within the rock fill. Below the rock structure three soil stratigraphic layers (I, II and III) were encountered (Fig. 5). Stratum I was 2 to 4 cm. thick, and consists of very loose, very dark grayish brown (10YR 3/3) silt loam with a high percentage of organics (leaf litter). Stratum I represents the modern filtered forest litter postdating the mound's construction. Stratum II was a maximum of 25 cm. thick and consists of loose dark brown (7.5YR 3/2) silt loam with 5 to 10 percent rockiness. One fragment of volcanic glass (.9 grams) and a piece of *kukui* nut (.2 grams) were recovered from Stratum II. Stratigraphically, Stratum II represents a natural soil layer predating the construction of the mound, thus the volcanic glass and *kukui* nut fragments are not associated with construction and/or use of the mound. Stratum III consists of slightly compact rocky dark yellowish brown

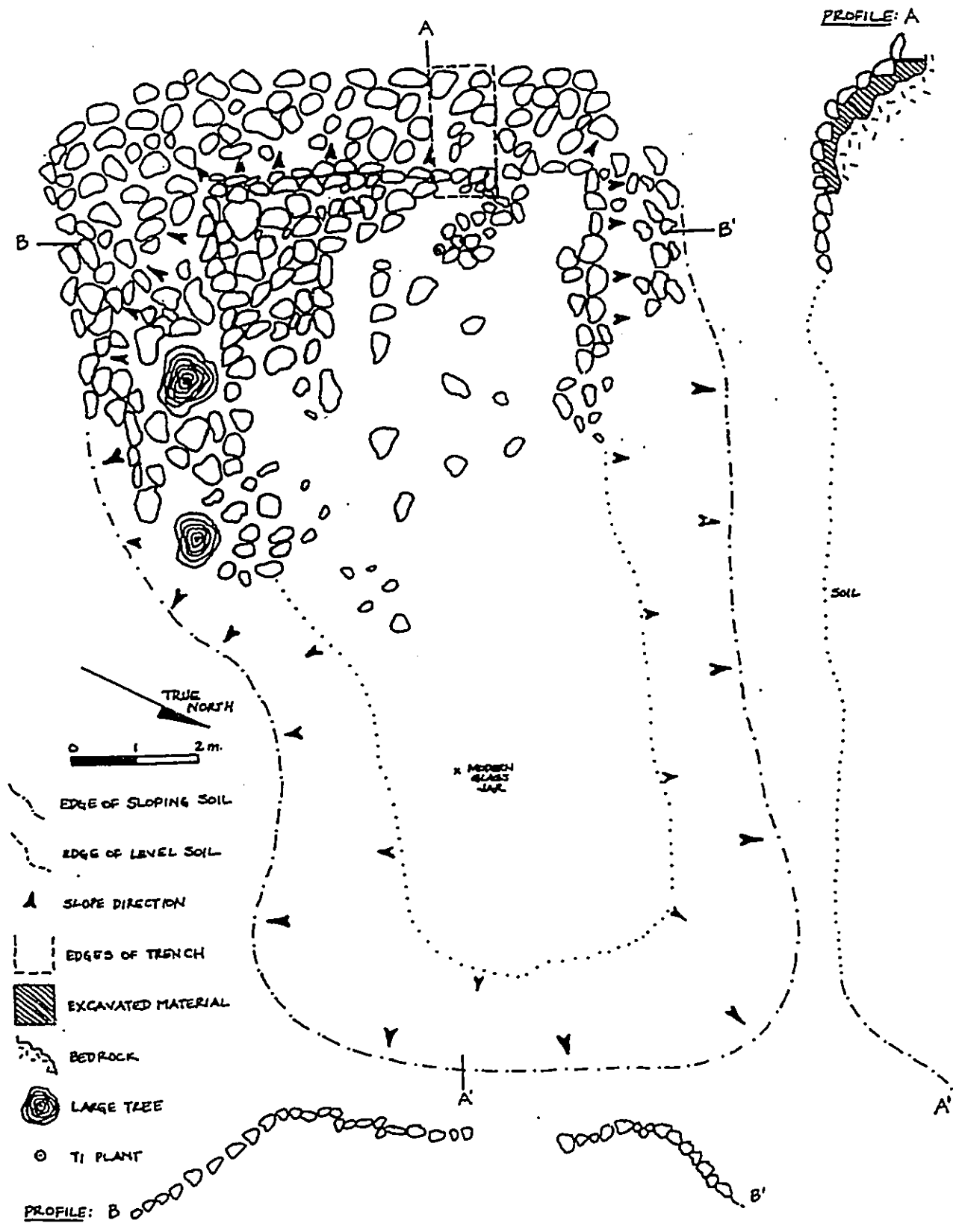


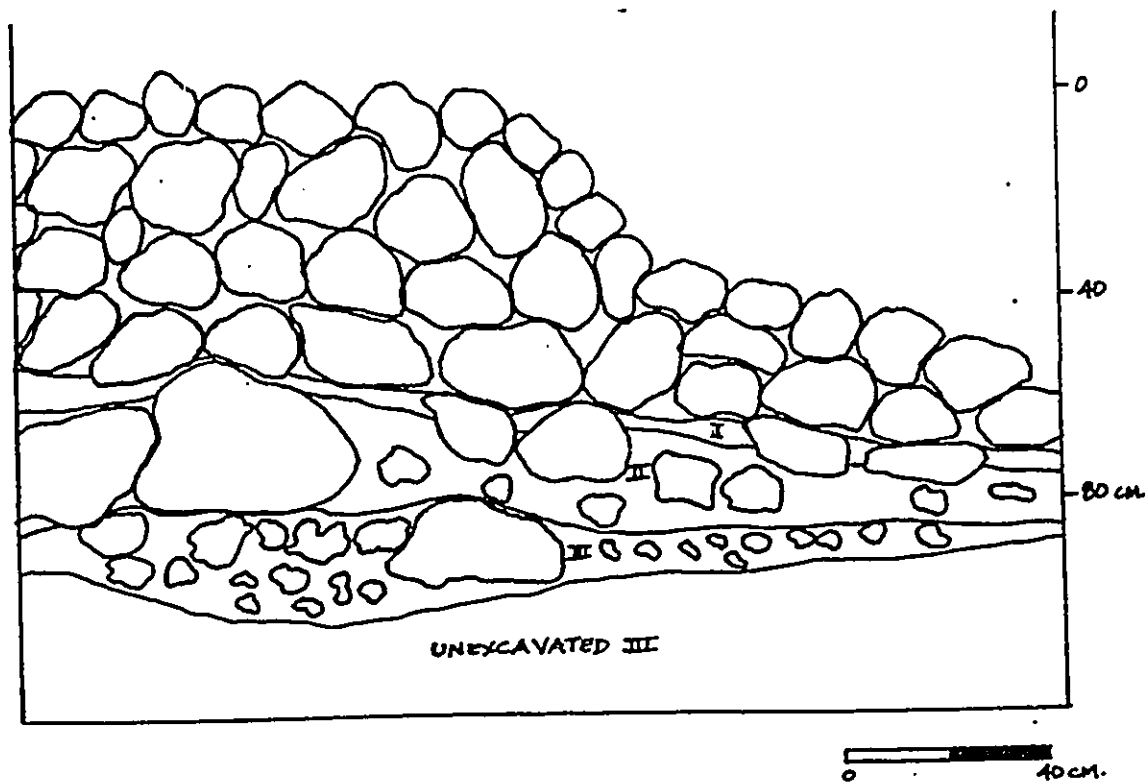
Fig. 4 Plan View and Cross Section of Tested Mound within Present Project Area, Feature of Site -18670

(10YR 3/6) silt loam. Stratum III represents the parent material soil layer or C Horizon which contains a high percentage of soft decomposing rock. No cultural material was within Stratum III.

The survey and testing within the present project area and previous background research for the Research and Technology Park (Borthwick *et al.* 1993:6-23) indicates that the features observed were associated with commercial sugar cane cultivation. Specifically, the features are situated within the former Waiakea Cane Lots (Portion of Lot #16). During the previous study a State Historic Site number (50-10-35-18670) was allotted for the cane lots' associated features within that specific project area (*ibid.*:39-42) (See Fig. 3). Since the four newly identified mounds were also associated with the same lot or sugar cane field we are including these features under the same State site number, 50-10-35-18670.

To further address functional interpretation, feature association, and sampling concerns, another mound within Site -18670 was subjected to sub-surface testing. The particular mound was chosen because of its size and location. The mound represents the largest, best defined stacked stone feature within Site -18670 boundaries (Fig. 6). The mound had been previously noted and drawn to scale (Borthwick *et al.* 1993:41,42), and accurately plotted on the study area map (*ibid.*, Figure 8:25) thus facilitating locational and feature type sampling choices as well as necessary field tasks (i.e., mapping and location).

A roughly 1.5 m. by 1.5 m. test unit was excavated into the southern side of the mound. The excavation revealed that the rock structure of the mound consists of a loose network of small boulders with no paving, no cultural material (i.e., midden or artifacts), and no filtered soil matrix. The mound is essentially sitting on top of underlying soil



STRATUM I: 4 CM. THICK; (10 YR 3/2) VERY DARK GRAYISH BROWN SILT LOAM; HIGH % ORGANICS; VERY LOOSE GRANULAR STRUCTURE; NO CULTURE

STRATUM II: 25 CM. THICK; (7.5 YR 3/2) DARK BROWN SILT LOAM; LOWER % ORGANICS; GRANULAR AND LOOSE; 5-10% ROCKS; ONE PIECE OF VOLCANIC GLASS AND ONE BURNT KUKUI SHELL

STRATUM III: 22 CM. THICK; (10 YR 3/6) DARK YELLOWISH BROWN SILT LOAM; "C HORIZON"; NO CULTURE.

Fig. 5 South Profile of Test Unit within Tested Mound in Present Project Area, Feature of Site -18670

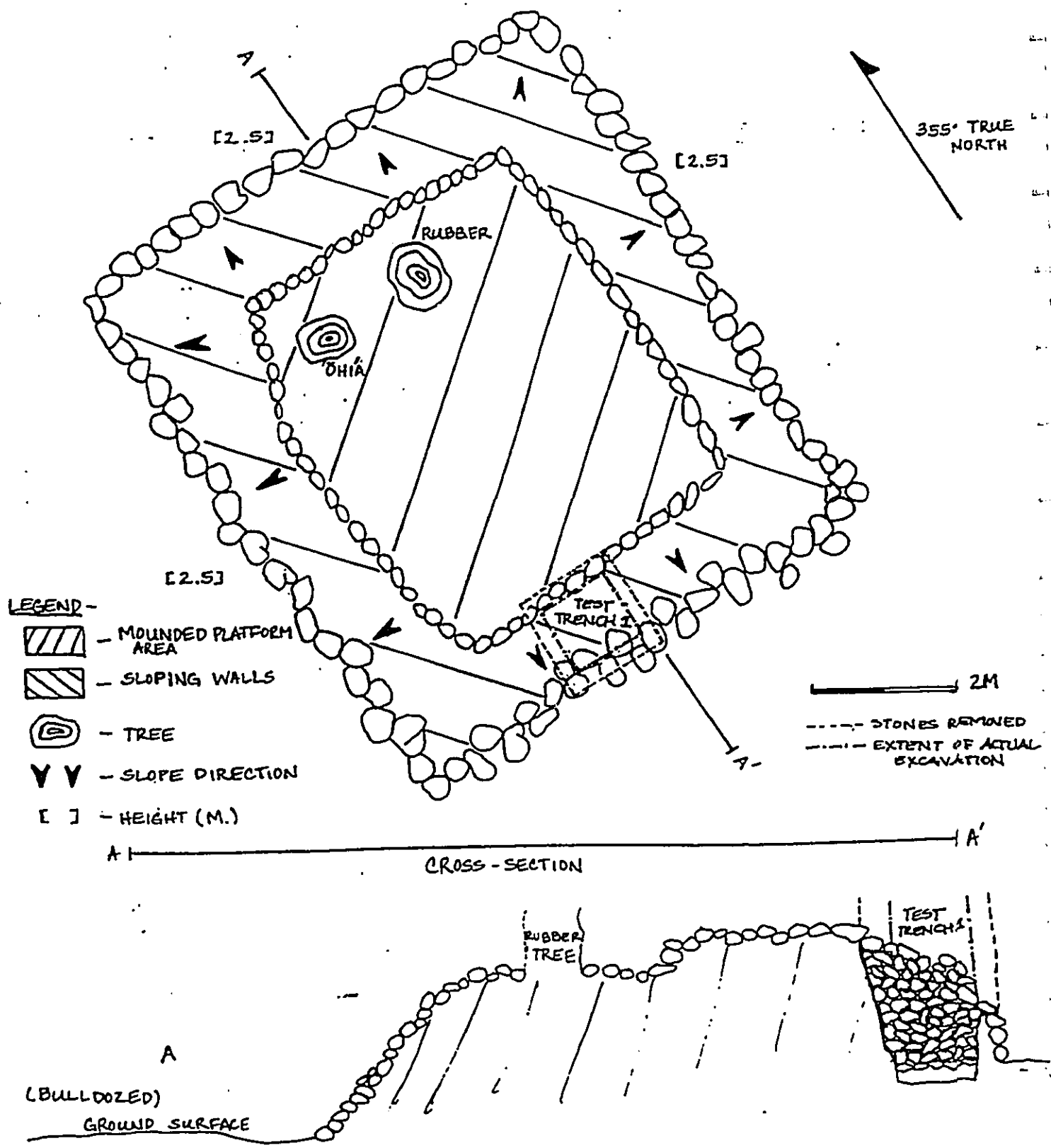


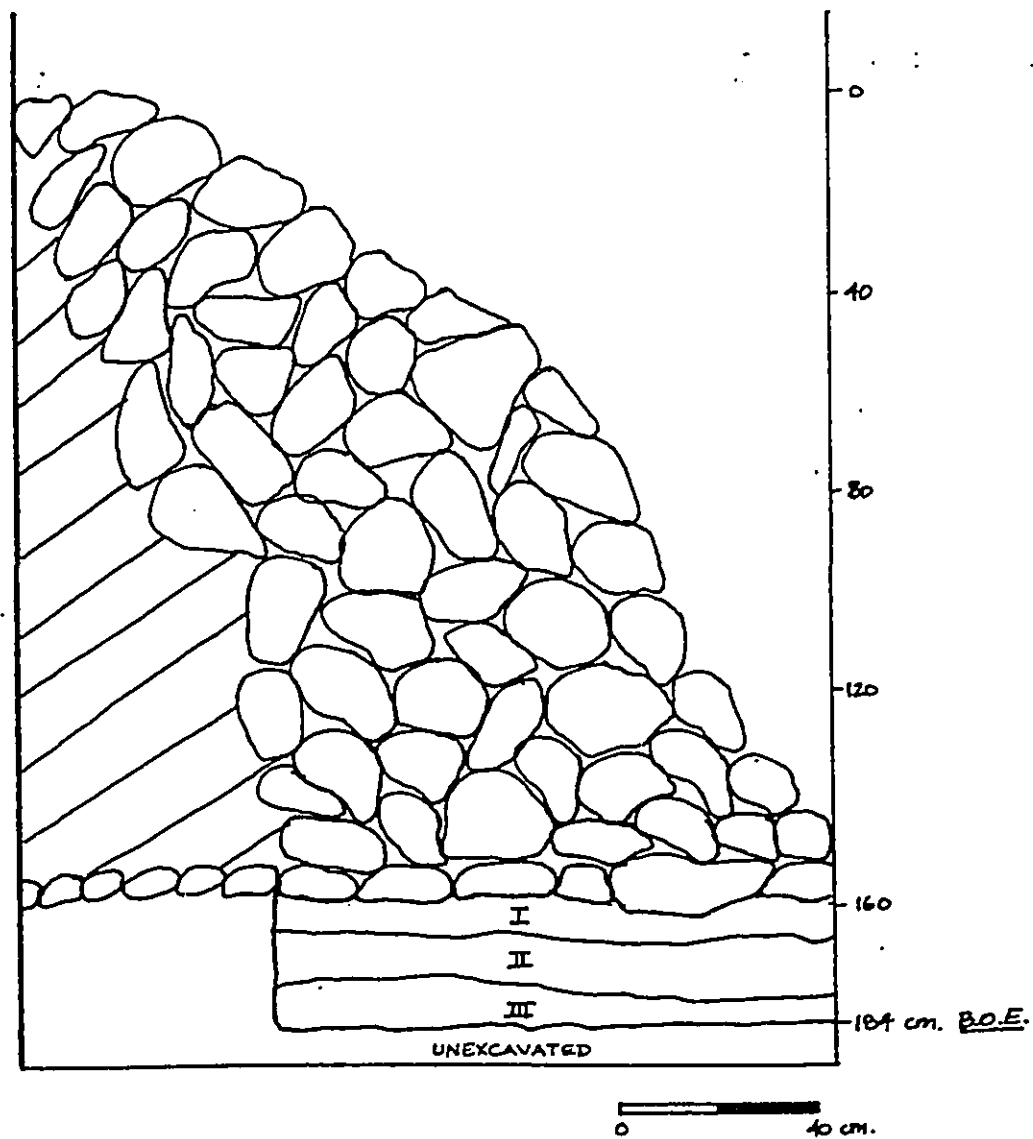
Fig. 6 Plan View and Cross Section of Tested Mound in Previous Study Area Portion of Site -18670 (Based on Figure 16 Borthwick *et al.*:42)



layers which, inclusive of the above-listed attributes, indicates the structure is relatively youthful age as there has not been sufficient time for soil to have filtered through the rocks and accumulated as a soil matrix within the mound. Additionally, the absence of cultural material and surface paving (pebble and/or coarse surface) argues against traditional Hawaiian usage (i.e. habitation and/or ritual).

Below the rock structure three soil stratigraphic layers (I, II and III) were encountered. No cultural material (midden, artifacts or charcoal) was within any of the strata which ranged from very dark brown (10YR 2/2) silty clay loam (Str. I) to dark yellowish brown (10YR 3/4) silty clay loam (Str. III). The degree of rockiness increased with depth ranging from 10% rockiness in Stratum I to a maximum of 40% in Stratum III. The soil layers clearly predate the construction of the mound and the profile represents natural *in situ* soil development (Fig. 7).

The sub-surface testing of this large mound did not reveal any evidence of traditional Hawaiian usage associated with the mound. The rock free, furrowed soil area surrounding the mound, construction style, and absence of cultural material indicate that the mound is a rock clearance feature associated with historic commercial sugar cane cultivation practices.



STRATUM I: 9 cm. THICK; (10 YR 2/2) VERY DARK BROWN SILTY CLAY LOAM TO SILT LOAM; 10% ROCKS

STRATUM II: 10 cm. THICK; (10 YR 3/2) VERY DARK GRAYISH BROWN SILTY CLAY LOAM; 10-20% ANGULAR PEBBLES

STRATUM III: 10+ cm. THICK; (10 YR 8/4) DARK YELLOWISH BROWN SILTY CLAY LOAM; 20-40% ANGULAR PEBBLES; STRONG CRUMB STRUCTURE

Fig. 7 East Profile of Test Unit within Previously Located Mound, Site -18670

## SUMMARY AND RECOMMENDATIONS

The present project area includes four rock clearance features (mounds) and a portion of a stacked boulder wall. The features were constructed and maintained historically as part of Waiakea Mill Co.'s sugar cane operations. The construction and maintenance of the mounds and wall were done to increase the cultivatable soil area by removing rocks from the fields and piling them into mounds and/or along field edges (e.g., the wall).

The extremely sparse material collected from the roughly 3 square meters of excavation (1 volcanic glass fragment and 1 *kukui* nut fragment) precludes any meaningful analysis. Both items could be naturally occurring within Waiakea Flood Plain soils. The volcanic glass fragment has not been utilized as a tool, based on absence of edge wear and/or retouching, as well as the poor vesicular quality of the material. The burnt *kukui* nut fragment may indicate previous forest clearing. However, such an assumption (or any other) based on a single .2 gram fragment is tentative at best.

Research for the proposed Pu'ainako Street Extension (Hunt and McDermott 1993), which includes similar stacked stone features within the former Waiakea Cane Lots, also indicated commercial sugar cane-related construction and maintenance of the rock structures. Hunt and McDermott, after "compiling diverse lines of complimentary evidence," which included oral interviews, photographs, newspaper articles, historic map analysis, inventory survey, and sub-surface testing, conclude that "The archaeological structures documented in the inventory survey are plantation-era in origin dating to the late nineteenth and early twentieth" (*ibid.*:93, 94).

The same conclusions were reached independently for the structural features reported on in our original report (Borthwick *et al.* 1993) for the survey of the Research

and Technology Park. The four mounds and wall, noted during the present survey are component features of the furrowed field (portion former Cane Lot #16) given State Site number 50-10-35-18670 (*ibid*:39-42) and thus should be included under the same (-18670) site designation.

Site -18670 was preliminarily (Cultural Surveys Hawaii recommendation) assessed solely under Significance Criterion D (site may be likely to yield information important in prehistory or history) and we are recommending inclusion of the four newly identified mounds (wall is already part of -18670) under the same significance assessment. That is, we are still recommending Criterion D only for Site -18670 and that the four mounds become part of the site.

The present study has neither altered significance assessment nor the recommendations of the original survey, for no further archaeological work specific to Site -18670, inclusive of the four newly-identified mounds. Sufficient data has been collected, analyzed, and reported on to define age and functional interpretation of Site -18670. Therefore it is our opinion that no further archaeological work is necessary. These significance assessments and recommendations are consistent with those made previously, for Site -18670 and described previously in the main body of the report.

## REFERENCES

- Borthwick, Douglas F. and Hallett H. Hammatt  
1993 *Archaeological Survey and Testing of Lands Proposed for Research and Technology Lots at the University of Hawaii at Hilo (TMK 2-4-01:40 and 157)*, Cultural Surveys Hawaii, Kailua, Oahu.
- Hunt, Terry L. and Matthew McDermott  
1992 *Interim Report: Archaeological Inventory Survey Puainako Street Extension Project: Lands of Waiākea, Kukuau 1 and 2, and Ponohawai, South Hilo District, Island of Hawai'i.*